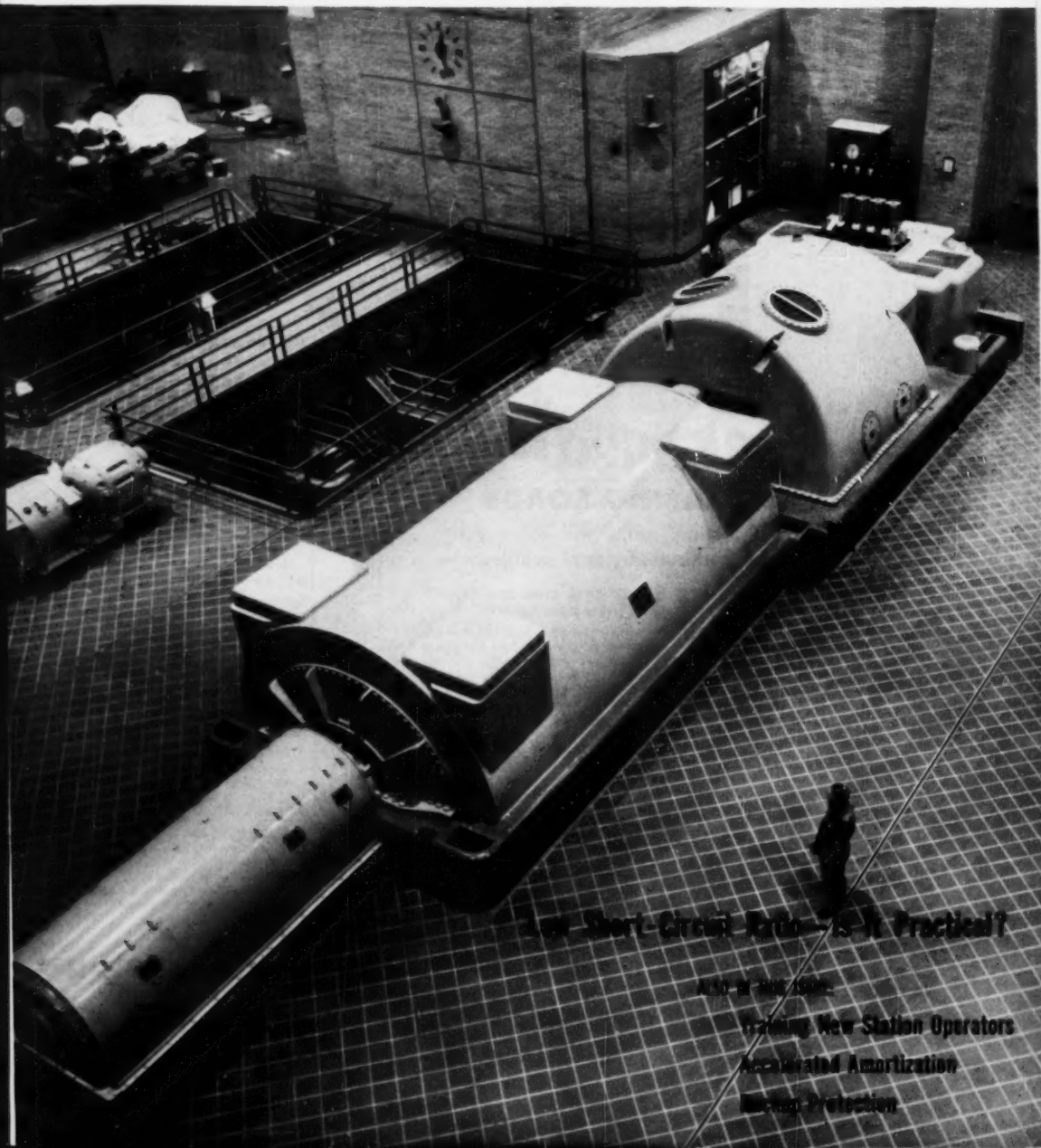
JUNE 30, 1952

Electrical World

FOR THIS WEEK'S NEWS — SEE PAGE 53

Price 35 Cents

A McGRAW-HILL PUBLICATION



How Short-Circuit Ratio—Is It Practical?

Also in this issue:

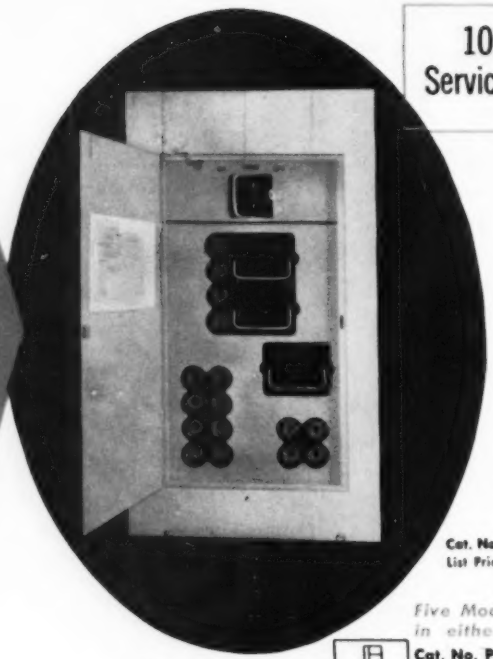
Training New Station Operators

Accelerated Amortization

Bus-tie Protection

ANOTHER NEW Murray PRODUCT

100 Ampere Service Equipment



Cat. No. PC316A
List Price – **$74.00**

HERE'S A "Packaged" SOLUTION TO INCREASING LOADS

Murray's "Combination" units will solve your main switch and distribution panel problems—

1 THEY PROVIDE BOTH SERVICE ENTRANCE AND BRANCH DISTRIBUTION IN ONE UNIT.

These Murray "Combination" service entrance and branch distribution units provide 100 Ampere main circuit breaker, fusible range and water heater pullouts, lighting and appliance plug fuse branch circuits – with or without a dryer pullout!

2 THEY PROVIDE FOR GROWING ELECTRICAL LOADS.

Any one of these five compact units offers a packaged solution to increasing loads. They are ideal for small commercial and large residential installations.

3 THEY SAVE TIME AND MONEY IN INSTALLATION.

Murray "Combination" units will save you time and money all along the line. Just one unit to *buy* – just one unit to *install* – just one unit to *wire*!

Factory bussing makes these units easy to wire. There's plenty of wiring room and all K. O's are conveniently located. Hook-on cover uses only two screws. Compact! Only 12-⅜ inches wide, designed to fit between building studs.

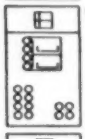
4 THEY GIVE DEPENDABLE CIRCUIT PROTECTION AT ALL TIMES.

Fully magnetic circuit breaker main consists of two independent trip, 1 pole, 100 Ampere 120/240 volt AC fully magnetic circuit breakers. Carries full rated load continuously. Handle bar permits simultaneous manual tripping to "off".

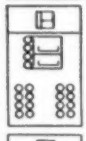
Murray's well-known fusible pull-out construction provides positive electrical contact. One piece fuse clip and blade prevents overheating.

Five Models to Choose from in either surface or flush.

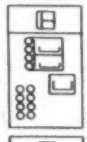
Cat. No. PC212A
100 Ampere main, fully magnetic circuit breakers
60 Ampere range fusible pullout
30 Ampere water heater fusible pullout
12 plug fuse branch circuits
List Price – **$57.00**



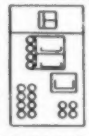
Cat. No. PC216A
100 Ampere main, fully magnetic circuit breakers
60 Ampere range fusible pullout
30 Ampere water heater fusible pullout
16 plug fuse branch circuits
List Price – **$64.00**



Cat. No. PC220A
100 Ampere main, fully magnetic circuit breakers
60 Ampere range fusible pullout
30 Ampere water heater fusible pullout
20 plug fuse branch circuits
List Price – **$71.00**



Cat. No. PC312A
100 Ampere main, fully magnetic circuit breakers
60 Ampere range fusible pullout
30 Ampere water heater fusible pullout
30 Ampere dryer fusible pullout
12 plug fuse branch circuits
List Price – **$67.00**



Cat. No. PC316A
100 Ampere main, fully magnetic circuit breakers
60 Ampere range fusible pullout
30 Ampere water heater fusible pullout
30 Ampere dryer fusible pullout
16 plug fuse branch circuits
List Price – **$74.00**

Write for full information to

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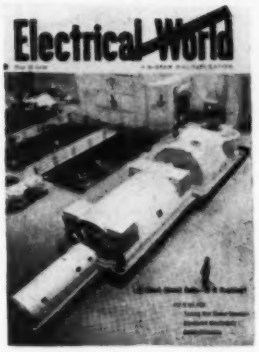
MURRAY MANUFACTURING CORPORATION

1250 ATLANTIC AVENUE · BROOKLYN 16, N.Y.

Service Entrance & Meter Equipment · Fully Magnetic Circuit Breakers · Switches (Types A, C and D)
Current Limiting Reactors · Crows' Nest Aerial Ladders



ON THE COVER

The handsome 80,000-kw reheat turbine-generator and turbine room shown on the cover of this issue are part of Niagara Mohawk's Dunkirk station, on the shore of Lake Erie.

MORE ABOUT ALUMINUM

Wherever distribution engineers gather these days, the subject gets around, sooner or later, to who is substituting aluminum for copper—where, why, and for what.

As a matter of fact the editors have been wondering about the same thing, for some time. And, like all editors (and engineers), when they get curious they make a survey.

They have asked nearly 100 leading distribution engineers all over the country how and where they are using this substitute conductor material. The answers will be part of a special section on aluminum in Electrical World's July 14 issue.

In addition to the survey on all-aluminum for distribution you will want to read the article by two leading wire and cable engineers entitled "Let's Use Aluminum—Not Abuse It." Then there will be an article on the installation of the first 15-kv aluminum underground cable as well as articles on the technique of making aluminum-to-copper connections in overhead lines and underground cables.

You won't want to miss this special section whether or not you are using aluminum on your system at the present time. Remember the date—July 14.

Electrical World

Published for 78 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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# of lead covered paper insulated cables

TWO-THIRDS of all cable failures are due to corrosion and mechanical damage. Okonite-Callender's cable design of Okometal of reduced thickness plus Okosheath Protective Covering specifically combats these two causes.

OKOSHEATH PROTECTIVE COVERING IS THE ANSWER TO CORROSION

Many corrosion preventives have been tried in the past, such as cathodic protection, protective greases, saturated fibrous or jute coverings. All, however, have very definite limitations. Only Okosheath Protective Covering meets the severe conditions imposed by duct or underground use. *In 18 years, no case of sheath corrosion has been reported on any cable having Okosheath Protective Covering.*

OKOMETAL PLUS OKOSHEATH PROTECTIVE COVERING IS THE ANSWER TO MECHANICAL DAMAGE

Okometal possesses unusual fatigue-resisting properties. This alloy was developed in the Okonite laboratories, with time-proved sodium-stabilized lead as a base. Under lab tests simulating actual man-hole bending, for example, *Okometal outperforms copper-silver-bearing lead close to three times!*

If you do not have all the facts on Okometal of reduced thickness plus Okosheath Protective Covering, get in touch with your Okonite representative today or write for your copy of Bulletin EW 1047R The Okonite Company, Passaic, N. J.

OKONITE-CALLENDER

TIGHT JOINTS

AT ALL POINTS . . . "VIA GRAYBAR"

Reliable Connectors, Splices

Graybar can supply everything your linemen need for connecting all types of lines *securely*. Two of the high-quality Reliable items we distribute are: (1) Solderless connectors—accurately cold headed. All parts are at least 98% copper, have no sharp corners, and have torque, compression, and reuse factors far above ordinary connectors. (2) Automatic splices and deadends for copper, ACSR, or steel strand—now filled with non-corrosive grease and packed to stay in perfect condition.

O-B INSULATORS

In these days of overloaded distribution systems, no line is stronger than its insulators. Graybar supplies superior-quality Ohio Brass insulators in strain, pin, and suspension types.

ONE SOURCE FOR ALL

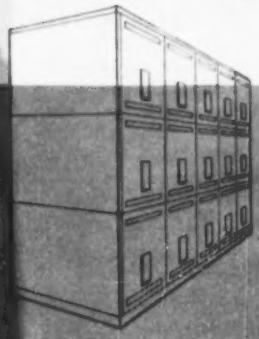
For both transmission and distribution lines, Graybar has everything "from the bottom of the hole to the top of the pole"! By ordering all your pole-line needs from this single source, you save time and paper-work expense. You get the leading lines of poles, crossarms, insulators, hardware, strand and tools. And you get them the quickest way possible—delivered wherever you specify.

Men who know your needs

When you call on Graybar, for supplies or for information, you can expect us to meet your needs both promptly and accurately. That's because Graybar has been familiar with your needs ever since the first lines went up. You're welcome to the help of the near-by Graybar Outside Construction Specialist in planning any pole-line or underground project. *Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.* 231-96

IN OVER 100 PRINCIPAL CITIES

To simplify switchgear problems...plan your

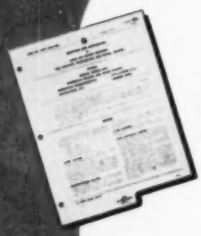


BEFORE YOU SPECIFY—SEND FOR YOUR FREE COPIES OF THIS INFORMATIVE I-T-E LITERATURE

I-T-E Selection and Application Data is specially prepared by I-T-E application engineers to help you through the important steps in planning your switchgear system.

CATALOG SECTION 1003—Comprehensive, illustrated 50-page catalog contains complete data on selection and application of I-T-E low-voltage air circuit breakers and individually enclosed circuit breakers (Uralites).

CATALOG SECTIONS 1104, 1304, 1404, 1504—Detailed description of construction, operation, and application of I-T-E's KA, KB, KC, and LG circuit breakers—and I-T-E's full line of auxiliary and trip devices. Catalogs give you useful tables, wiring diagrams, mounting instructions, and dimensions.



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FREE

I-T-E CIRCUIT BREAKER CO.
Switchgear Division, Dept EW
19th and Hamilton Sts.
Philadelphia 30, Pa.

Please send me the catalogs which I have checked:

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- ☐ Catalog Sections 1104, 1304, 1404, 1504
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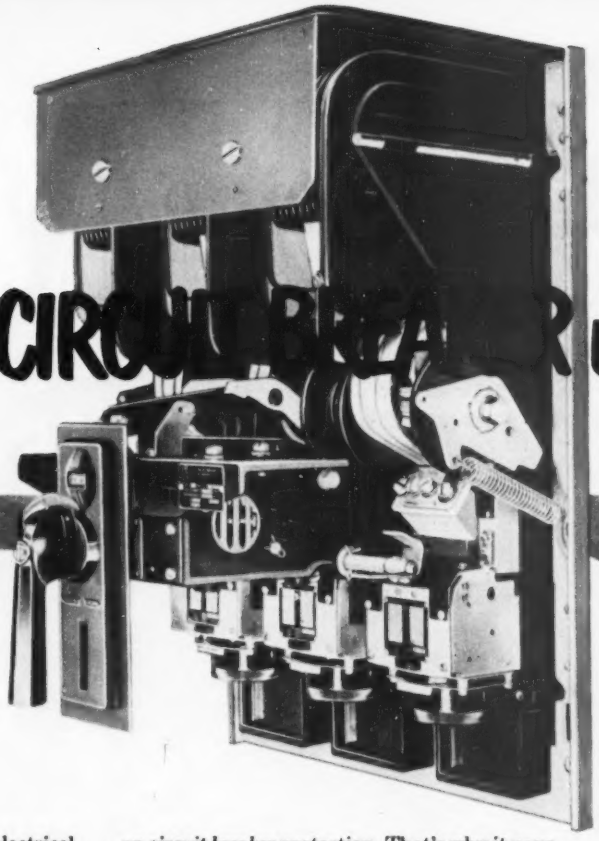
LOW-

I-T-E CIRCUIT

Canadian Mfg. & Sales:

layout from CIRCUIT BREAKER up



I-T-E CAN SUPPLY INDOOR AND OUTDOOR EQUIPMENT IN RATINGS:

15,000 to 100,000 amperes interrupting
600 volts a-c, 250 volts d-c
to 6,000 amperes continuous, a-c or d-c
to 10,000 amperes continuous, d-c only

Expansion or modernization of your electrical distribution system calls for detailed analysis. Before you can properly select your system and equipment, you must consider such important factors as load, power supply, circuits, *protection*, and *reliability*.

This means getting down to fundamentals. And, fundamentally, system reliability depends on *circuit breaker* protection. That's why it pays to think of your switchgear requirements *first of all* as circuit breaker applications.

Follow these three simple steps when planning your switchgear layout. You can then be sure that the circuit breakers you buy will provide the protection you need:

- **KNOW YOUR APPLICATIONS**—their load characteristics, protection requirements, need for continuity of service;
- **KNOW THE CIRCUIT BREAKER** features and functions that will satisfy all application requirements;
- **KNOW THE MANUFACTURER**—his ability to help you solve your problems and provide the best breakers for the job.

I-T-E experience and specialists are at your service. Your local I-T-E application engineer will gladly work with you on any switchgear problems. Get to know him. Give him a call—*today*.

VOLTAGE SWITCHGEAR

BREAKER COMPANY • 19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

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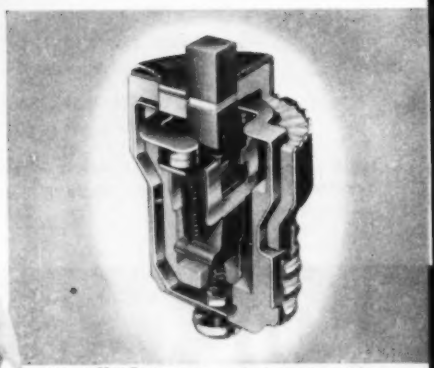
Introducing MINI

. . . the amazing



This is **MINI-BREAKER**—compactly designed, precision engineered, and individually tested after assembly to assure permanent trouble-free circuit breaker protection!

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-BREAKER®

new miniature circuit breaker that fits like a fuse in any standard plug-type fuseholder!

NEVER before has there been a circuit protective device quite like the amazing new MINI-BREAKER. Because here, for the first time, is a *thoroughly tested* miniature branch circuit breaker that can actually be used as a *direct replacement* for expendable plug-type fuses! Installed by anyone in a matter of seconds in any standard Edison base fuse receptacle. Used with confidence, too, wherever 15, 20 and 30 ampere circuits exist for 110-125 volt a-c service. For although many attempts have been made to develop just such a practical low-cost device, MINI-BREAKER is the first and only product of its kind ever to meet the requirements specified for listing as a "Circuit Breaker-Miscellaneous" by Underwriters' Laboratories, Inc. And, when commercially available, it will bear the Re-examination Service marker.

Anyone can install a MINI-BREAKER in seconds! And anyone can restore electrical service simply by pressing and releasing the reset button!

Provides Permanent, Positive Protection Against Overloads and Short Circuits!

Yes, in spite of its compact size and its basic resemblance to the fuse it is designed to replace, MINI-BREAKER is a full-fledged circuit breaker in every sense of the term. A precision built assembly of carefully selected, perfectly balanced parts . . . all permanently protected and enclosed within a durable insulating case.

In operation, MINI-BREAKER safely interrupts excessive overloads and short circuits . . . tripping instantly on "shorts", but with a built-in time lag for handling temporary starting loads and line surges. Whenever an interruption occurs, service can easily be restored by anyone . . . normally within 10 seconds . . . simply by pressing in and releasing the reset button. Yet, in spite of its quick recovery, MINI-BREAKER is 100% trip-free. That is, it positively will not maintain a circuit that has not been cleared of the condition that caused the interruption.

What's more, while MINI-BREAKER is a thermally actuated breaker, it's virtually uneffected by the changes in ambient temperatures encountered under normal installation conditions. Because, although designed exclusively for ordinary residential, commercial, and industrial service, MINI-BREAKER actually meets and exceeds the temperature extreme conditions required for approval for aircraft use. MINI-BREAKER trips at 200% load within four minutes at −50°F., carries rated current continuously at 135°F.!

What can MINI-BREAKER *do for an Electric Utility?* Plenty! Just count the number of fuse-protected circuits on your lines today. Add the needless cost and inconvenience . . . to you or your customers . . . in replacing blown out fuses. Then project the increased revenue that would result if all those customers were to convert all those circuits to permanent, low-cost MINI-BREAKER installations! A worthwhile project, you'll agree. And we're ready to help you start it . . . *NOW!*

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Want More Information on MINI-BREAKER? Regardless of what your interests may be, we'd like to tell you more about MINI-BREAKER. A request on your company letterhead . . . or the coupon below . . . will bring you complete details by return mail.

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Gentlemen:

Please send me the complete MINI-BREAKER story at once!

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COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

FOR HIGHWAYS . . .

. . . OR BYWAYS

Cable jacketed with neoprene gives longer, more dependable service

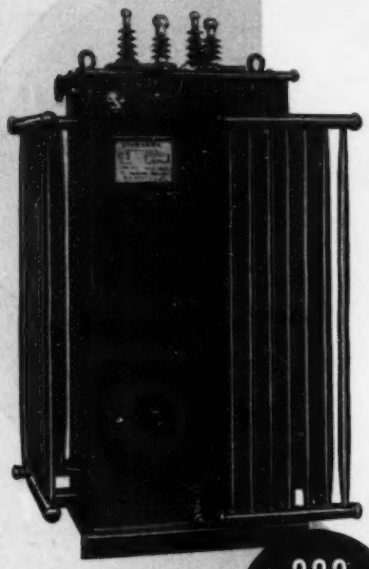
IN MODERN highway lighting, cable is installed underground both for appearance and safety. The use of neoprene-jacketed cable for such installations is becoming more and more widespread as it proves itself on job after job. For neoprene is not subject to galvanic action which destroys metallic sheaths. Soil acids won't cause it to rot. And, where the line must be run above ground, this same neoprene jacket has resistance to sunlight and weathering that is unexcelled. On weatherproof wire, neoprene withstands long exposure to sunlight, heat and weathering . . . won't sag or cold flow on the wire. It is tough and resilient, stands up under scuffing and abrasion from tree limbs.

Today, there's long lasting neoprene-jacketed cable for practically any job. Your supplier will be glad to tell you more about this better kind of cable. It is made in single or multiple conductor types, in voltage ratings to fit your requirements. New and interesting applications of neoprene are fully described in each issue of The Neoprene Notebook. Write today for your free subscription. E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division G-6, Wilmington 98, Delaware.

NEOPRENE

DU PONT

TWO NEW Type HD UPTEGRAFF DISTRIBUTION TRANSFORMERS



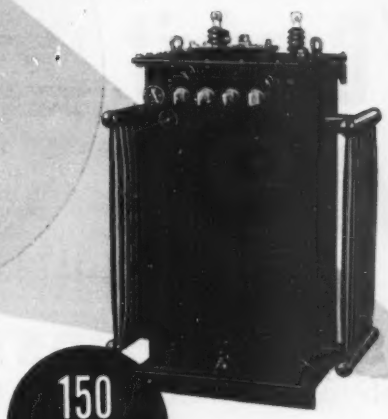
333 KVA

Type HD, single phase, 60 cycle oil-filled distribution transformer, 333 KVA, 12470-2400/4160Y volts.

Shown here are two new Uptegraff Distribution Transformers. Both are oil-immersed units for outdoor installation.

Core and coil assemblies are designed for even distribution of potentials by avoiding points of high dielectric stress. They are thoroughly dried and impregnated while warm. Radiators are readily accessible for cleaning and painting. Tanks are of heavy gauge, shot-blasted steel covered with three coats of paint specially selected for the lasting protection it affords. Tank bottoms are undercoated.

The complete Uptegraff line includes transformers for all classes of service, from the smallest specialty transformers to 10,000 KVA Power Units, including dry and liquid-filled types for indoor and outdoor service. We can quickly meet your needs with transformers built to your specifications.



150 KVA

150 KVA type HD single phase, 60 cycle oil-filled unit 2400/4160Y-120/240 volts.

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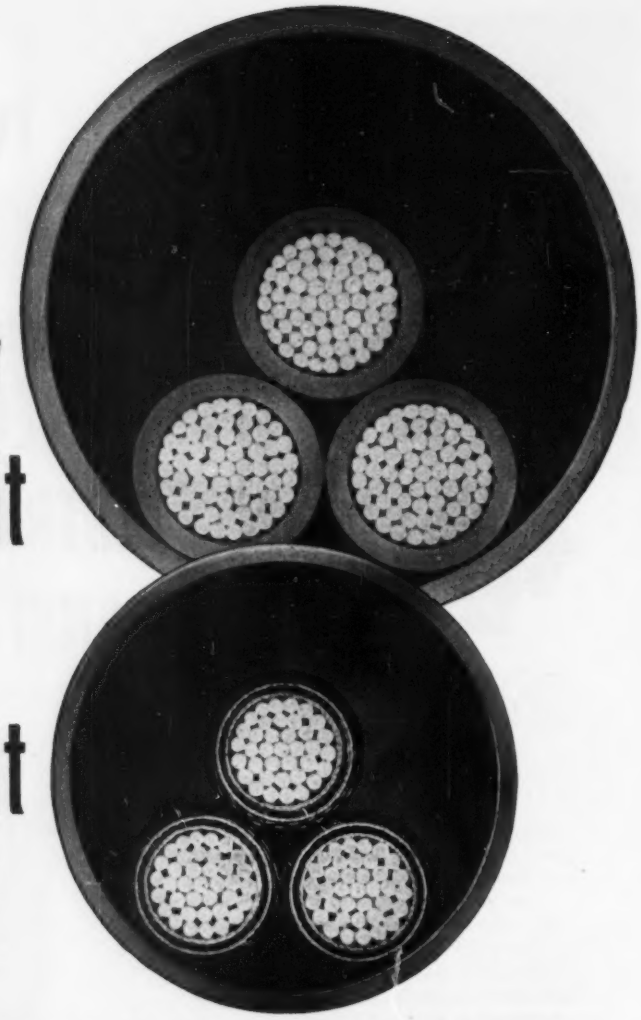
Why Buy 4" Conduit when 3" Conduit will do?



INSTALLED COSTS ARE LOWER

with high-rated ROCKBESTOS A.V.C.® and a 430 Ampere Load*

- you buy 25% *smaller* conduit
- you use 38% *smaller* cable
- you use *smaller* fittings and lugs
- you have lower labor costs because smaller, lighter cable and conduit are quicker and easier to handle.

To save money specify *permanently-insulated* Rockbestos A.V.C. Write for the booklet "The Story of An Insulation."

*Comparison made with Type RH based on Chapter X, National Electrical Code, 60°C-104°F Ambient

ROCKBESTOS A.V.C.

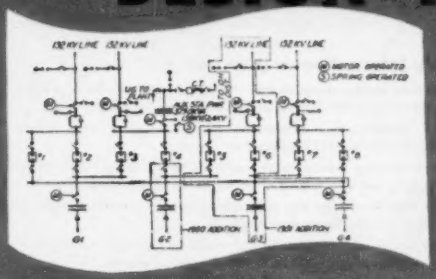
ROCKBESTOS PRODUCTS CORPORATION, NEW HAVEN 4, CONN.

CLEVELAND DETROIT CHICAGO PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CAL.

here's the easy way to solve

your substation

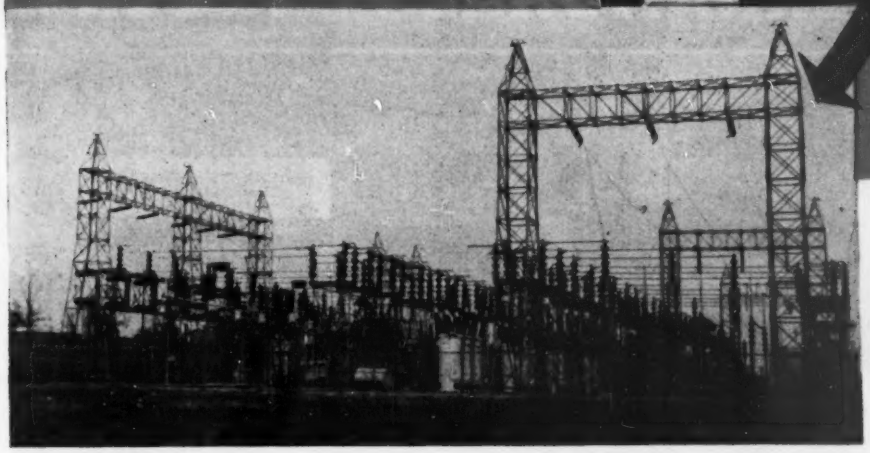
DESIGN PROBLEMS



STEP 1—Make one line diagram with specifications. No station layout required.

STEP 2—Submit to Southern States.

STEP 3—The station shipped to job site ready for erection.



Through the years Southern States' experienced team, skilled in engineering, procurement and manufacturing, has provided **single responsibility service** in meeting your substation requirements. Whether it be detailed engineering or materials ordering for job site delivery, we relieve you and your staff of the many details necessary to coordinate procurement with construction schedules.

Southern States
HAMPTON

Equipment Corp.
GEORGIA

The only question is "when?"

Sooner or later the man looking for a better truck buys an International.

Then he wonders why he didn't do it sooner. He gets better performance, he cuts costs, he makes more money.

If that's what you want, the only question is "when?"—when are you going to see your International Truck Dealer or Branch and get all the facts about the new International Truck that is engineered to do your job better, at lower cost?

INTERNATIONAL HARVESTER COMPANY • CHICAGO

Only Internationals give you—

- All-truck engines designed exclusively for truck work, developed and built in the world's largest exclusive truck engine plant.
- The "roomiest, most comfortable cab on the road"—the Comfo-Vision Cab designed by drivers for drivers.
- Super-steering system—more positive steering control with easier handling and 37° turning circle for greater maneuverability.
- The traditional toughness of trucks which have been first in heavy-duty truck sales for 19 straight years.
- The world's most complete line of trucks . . . 115 basic models, from ½-ton pickups to 90,000 lb. GVW off-highway models.
- Service by nation's largest exclusive truck service organization.

International Harvester Builds McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

INTERNATIONAL TRUCKS

More than One Million Now on the Road

Model L-120, 127 inch wheelbase, special utility body, 5,400 pounds GVW.

Another Example of L-M Leadership

L-M's ORTO

(oxidation-resistant transformer oil)

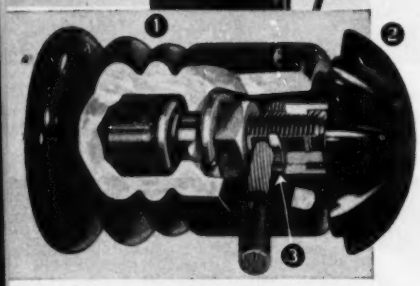
gives you all these advantages:

- longer life for the transformer, with the same overload capacity, or . . .
- higher overload capacity with the same transformer life
- reduced oil acidity and sludging
- maintained high impulse strength

and

- ORTO mixes with any other oil, conventional or inhibited
- ORTO will not react with other inhibitors
- ORTO is available as a *concentrate* for adding to your present oil stocks, for adding to power transformer oils, and for prolonging the life of reclaimed oil

Since its announcement, which led the industry, ORTO® has been a phenomenal success. Naturally L-M and L-M research engineers are gratified by ORTO's acceptance and this acceptance was deserved, by the long, rigorous careful checking into oils and inhibitors. New accelerated test methods were developed, to make sure that ORTO was as good as expected. ORTO was thoroughly tested and proved by extensive investigation and accelerated life tests representing many years of service.

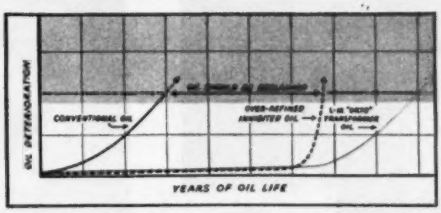


L-M'S NEW SIDEWALL BUSHING

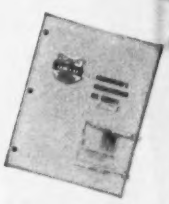
For fast, permanent transformer connections. Heavy machined wet-process porcelain (1) with ample leakage distance. Extra strong finger-grip handle (2). Lineman inserts bared end of conductor into the connector (3), spins the knob tight. Hole only on one side of bushing; wire can't go through to snag clothes or cause accidental contact. Leak-proof, inherently siphon-proof; takes up to two full-size conductors.

L-M DISTRIBUTION TRANSFORMERS

Available in sizes up to 500 kva, voltages from 480 to 14,400, all ORTO-filled. Dry types 1½ to 50 kva, 600/120-240 volts.



Comparative curves show the deterioration of transformer oil in service. A high-grade conventional oil deteriorates at a gradually accelerating rate. Over-refined oils may have a better response to the inhibitor; but once the inhibitor has been used up, the oil has little resistance to oxidation, and deteriorates rapidly. ORTO brand oil is a high-grade conventional oil with an inhibitor which greatly extends the beginning of the deterioration, which, when it finally starts, assumes the same gradual curve as with any high-grade conventional oil.



Ask the L-M Field Engineer for information on ORTO; or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

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LINE MATERIAL . . . Transformers

Complete Coordinated Equipment for Distribution Today

FIGURE 1—Earl J. Kirsch, Assistant Manager, Transformer sales, exhibits the L-M Round-Wound core-coil assembly, which provides an almost ideal magnetic circuit. The wound core has no air gaps; has stable characteristics, low exciting current. Long round coils wound directly onto the core encircle a large part of the core, making possible fewer winding turns and lower copper loss.

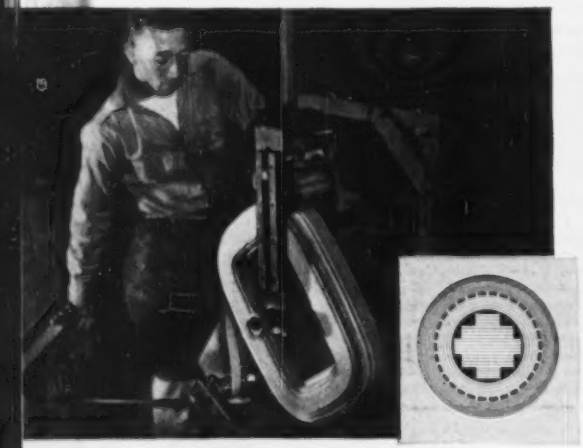

FIGURE 2—Core is tightly wound, under tension, of continuous strip of oriented silicon steel, of varying widths to provide a core of nearly round cruciform cross section.

FIGURE 3—The cross section of the wound core is cruciform, closely approximating a round form.

FIGURE 4—After the core is annealed, coils are wound directly on the *uncut* core, by means of split winding flanges driven by gears on the L-M exclusive winding machine.

How L-M Round-Wound Design Cuts Losses in Distribution Transformers

by **James G. Everhart**, Chief Engineer, Transformer Division, Line Material Company

Utility companies are under terrific pressure today between higher costs and higher taxes on the one hand, and lagging revenues on the other hand. Today, as never before, power must be distributed with the utmost economy, and great attention is being devoted to the reduction of every possible loss.

Transformer losses are one factor that is receiving extensive study, by both the operating companies and the manufacturers.

In this economy drive, transformer loading is also receiving major attention, with a view to maximum utilization of equipment—and this introduces another factor into the study of losses.

The Battle for Savings

The ratio of losses of a distribution transformer affects overload capacity. The copper loss watts vary as the square of the overload. In comparing two transformers of identical physical proportions including coil cooling surface exposed to oil, it is obvious that the unit with higher copper loss has less overload capacity before damaging temperatures are reached than does the transformer with lower copper loss. This effect is further emphasized by the fact the high copper loss dictates a small unit with less surface.

Core loss, on the other hand, is something the utility company pays for 24 hours a day. Therefore the designer must take both core and copper losses into account in providing the best possible balance of performance characteristics.

Exciting current, another factor in operating cost, is deserving of attention, and should be reduced to whatever extent can be done by a design that does not at the same time sacrifice other performance characteristics.

"Balanced Performance"

To meet these considerations, transformer design must essentially be a series of compromises. The L-M Round-Wound transformer consists of a wound core, with long round coils wound directly onto the core (Figure 1). This construction offers certain inherent advantages which make it possible for L-M designers to minimize compromises and offer *balanced performance*.

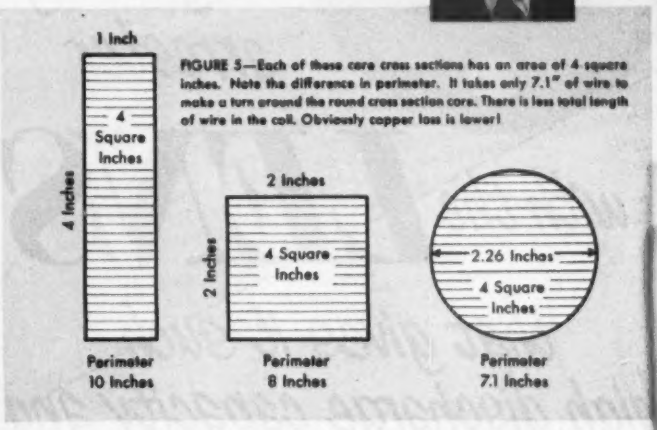

FIGURE 5—Each of these core cross sections has an area of 4 square inches. Note the difference in perimeter. It takes only 7.1" of wire to make a turn around the round cross section core. There is less total length of wire in the coil. Obviously copper loss is lower!

Wound Core Is Not Cut

First of these inherent advantages is the exclusive L-M wound core itself. It is tightly wound of continuous strip of cold rolled oriented silicon steel, with no cuts, laps, or gaps (Figure 2). This superior core makes possible the higher overload capacity and balanced losses of the Round-Wound transformer.

Lower Exciting Current

Since the core is not cut, no air gaps are created which would break up the flux path and produce higher exciting current, with consequent loss in revenue.

Low Core Loss

The higher magnetic efficiency of this core makes it possible to achieve low core loss easily, while the core at the same time contributes greatly to balanced performance. Incidentally, this continuous core is also far more quiet than one which contains air gaps.

Another advantage of the L-M wound core lies in the fact that the cross section is cruciform, approaching the round (Figure 3). Round coils are wound directly onto the core in an L-M designed winding machine (Figure 4). As shown in Figure 5, these coils allow a reduction in the perimeter of the coil and permit more efficient utilization of the copper. With the same cross section wire, and the same number of turns, there is less total length of wire, and less watts of copper loss. This is one of the inherent advantages of the L-M wound core that gives the designer more leeway in achieving a proper balance of performance characteristics.

Detailed typical performance characteristics of Round-Wound transformers are available from the L-M Field Engineer, or by writing Mr. Everhart at the Transformer Division, Line Material Company, Zanesville, Ohio (a McGraw Electric Company Division).

"Round-Wound" is a Line Material Co. trademark.

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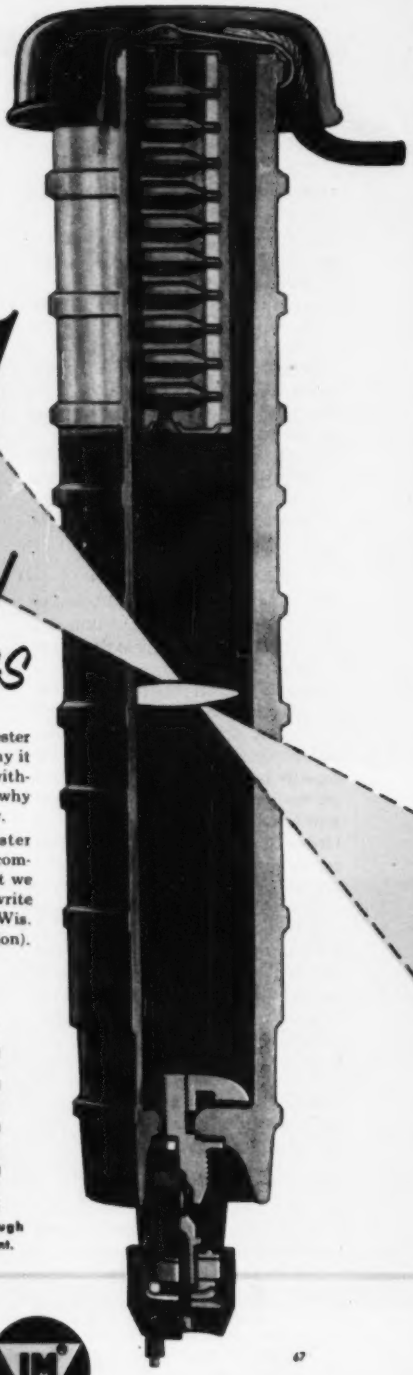
LINE MATERIAL Transformers

Complete Coordinated Equipment for Distribution Today

the only lightning arrester with the LENS that gives it such high discharge capacity and unchanging characteristics



An ingeniously designed lens electrode is placed in the valve element of *every* L-M valve type arrester. This exclusive L-M feature performs an extremely valuable function that accounts for the exceptional performance and long life of L-M arresters.

Here's why. Lightning surge current tends to "skin" down the outside of the valve element, just as 60-cycle current will flow on the skin of a conductor. This results in only a small portion of the valve element being used to handle lightning surges. Thus the surge capacity of what might be a good arrester is materially lowered—the valve element will fail in time due to the excessive concentration of current on the outer skin.

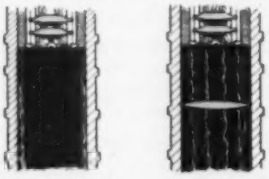
The L-M lens electrode completely counteracts lightning surge current "skin effect." The full cross-section of the valve element is available for extremely high surges—considerably in excess of 65,000 amperes.

The lens does the job. It distributes the surge evenly throughout the valve element—doesn't allow it to concentrate in any one path and thus clinker the element.

That's one reason why an L-M arrester can take more and heavier surges—why it maintains its high discharge capacity without change, for years and years . . . why its rate of failure is so gratifyingly low.

Get the whole story on L-M arrester performance, including some utility company records which substantiate what we say. Ask the L-M Field Engineer, or write Line Material Co., Milwaukee 1, Wis. (a McGraw Electric Company Division).

Here's What Happens



Without LENS
Surge channels down sides of element.

With LENS
Surge goes through the entire element.

LINE MATERIAL
Lightning Arresters

Complete Coordinated Equipment for Distribution Today

UTILITY DATA SHOWS OUTSTANDING 99.94% PERFORMANCE RECORD FOR L-M VALVE TYPE LIGHTNING ARRESTERS

Six-year performance records of a large midwestern utility show that L-M valve type lightning arresters have an exceptionally good operating record. With a total of 41,175 service years, only 23 L-M arresters had Isolator* operations while in service—there was only one instance of radio interference from L-M arresters—and of 613 arresters brought into the shop for electrical testing, not one was found faulty.

Here are the records for the years 1945 through 1950.

Year	Arresters in Service	Isolator Operations in Service	Number Tested	Failed in Test
1945	3,286	5	0	0
1946	4,322	2	11	0
1947	6,020	2	137	0
1948	7,469	4	118	0
1949	8,686	3	186	0
1950	11,392	7	161	0
Total Arrester Service Years	41,175	23	613	0

23 ÷ 41,175 = .056% failure rate

This substantiates the claims that L-M engineers have always been able to make—that L-M arresters give remarkable protection, excellent performance, and long life with unchanging characteristics.

Testing Greatly Simplified. The Pyrex® glass housing of L-M valve type arresters allows you to "test by sight." You don't have to make an electrical test of every single arrester. Just look at the spark gap—any irregularities can be detected by sight. If the Isolator* is intact you know the valve element is okay. That's all there is to it—if you use L-M Pyrex-housed valve type lightning arresters.

Get Complete Details. For complete information on L-M Lightning Arresters, and details of visual test methods, ask the L-M Field Engineer, or write Line Material Co., Milwaukee 1, Wis. (a McGraw Electric Company Division).

LINE MATERIAL

Lightning Arresters

Complete Coordinated Equipment for Distribution Today

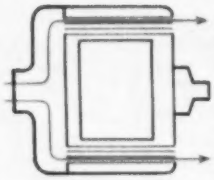
*"ISOLATOR," watchdog of arrester trouble, gives positive assurance against grounding feeders through damaged arresters, by disconnecting the ground lead from the arrester. (As shown in the operating company records above, in 41,175 arrester-years there were 23 Isolator operations, which provided this protective disconnecting service.)

Your *Best* Motor Buy

for Outdoor Installations

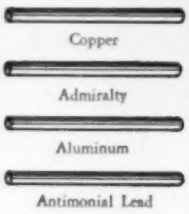
Here's Why

Practically Self-Cleaning



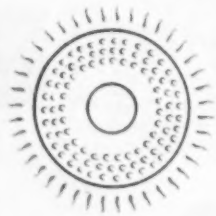
Air-to-air heat exchanger has straight, smooth tubes with no pockets in which dirt or moisture can collect. Velocity of cooling air through the tubes keeps surfaces swept clean. If sticky dirt should pile up, the tubes can be cleaned in a few seconds with a long handled brush.

Choice of Tube Materials



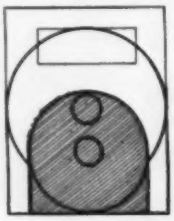
Allis-Chalmers tube-type motors can be built for service in corrosive atmospheres and for outdoor operation in almost any climate. Tubes may be made of a variety of materials, depending on service conditions.

Uniform Cooling



Tubes for carrying cooling air are distributed uniformly around the perimeter of the stator and along its full length. Result: heat travels over a short path and the interior is uniformly cooled.

Compact



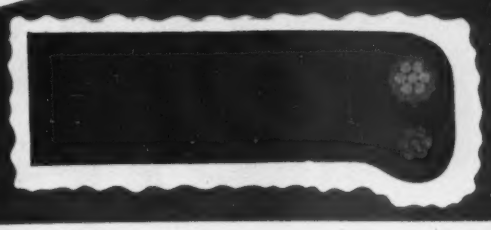
Allis-Chalmers tube-type motors are little or no larger than open motors of the same rating. Tube-type design exposes large surface area to cooling air in minimum space.

Get Complete Information Now — Ask your Allis-Chalmers district office representative about tube-type, totally-enclosed fan-cooled motors in sizes up to 2000 hp. Or write Allis-Chalmers, Milwaukee 1, Wis., and ask for Bulletin 51B7150.

A-3747

ALLIS-CHALMERS

REPEAT ORDERS CONFIRM POPULARITY OF TIREX SHUTTLE CAR CABLE



Simplex-TIREX Shuttle Car Cable with the unusual "geared" design is barely more than two years old, yet it has already achieved widespread popularity.

The reason for this unusual popularity is not difficult to find. It is told in repeat orders and in letters from enthusiastic customers. Repeat orders, of themselves, are the finest testimonial any product can receive.

The letters explain why customers are buying Simplex-TIREX Shuttle Car Cable to the exclusion of all other types for shuttle car and mining machine service. The reasons given are many and varied but they all add up to the same conclusion. TIREX Shuttle Car Cable gives longer life under more rugged conditions and will haul more tons of coal per dollar of cable cost. That's a darn good reason for anybody to buy a product.

Shuttle car cable was developed to meet specific mining problems. It is another example of our willingness to disregard conventional thinking to solve difficult problems. Do you need help on a cord or cable problem?

SIMPLEX-TIREX IS A PRODUCT OF SIMPLEX RESEARCH

SIMPLEX-TIREX

SIMPLEX WIRE & CABLE CO 79 SIDNEY ST CAMBRIDGE 39 MASS

What has caused this tremendous swing to Riley Traveling Grate Spreader Stokers?

As more and more Riley Traveling Grate Spreader Stokers have been placed in operation Riley Spreader Stokers are being selected by greater and greater numbers of the country's leading public utility and industrial plants—to such an extent that to date in 1952, Riley has sold more traveling grate spreader stokers than all other companies combined.

We believe the fundamental reason for this tremendous swing to Riley is that news of the excellent results and satisfactory performance of Riley Spreader Stokers has traveled rapidly from plant to plant. Such satisfactory performance is largely due to design characteristics and the vast experience of Riley in the stoker field.

THE GRATE SURFACE The grate surface is made up of small clips, two inches wide by six inch pitch, mounted on structural T bars. The use of small grate clips eliminates warping and cracking and assures low maintenance and long life by providing adequate cooling. Clips are of nickel-chrome alloy to minimize growth. A level grate surface and uniform air distribution results.

THE FEEDER-DISTRIBUTOR The feeder is designed to give uniform positive feed regardless of coal characteristics and moisture. Avalanching with fine coal does not occur. The overthrowing distributor gives uniform longitudinal and lateral distribution and prevents damage and outage caused by wedging of foreign materials between distributor and housing.

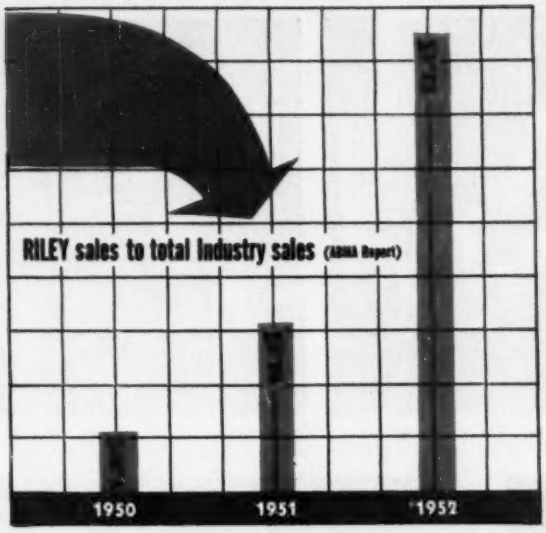
TRADE MARK Rx REGISTERED

RILEY

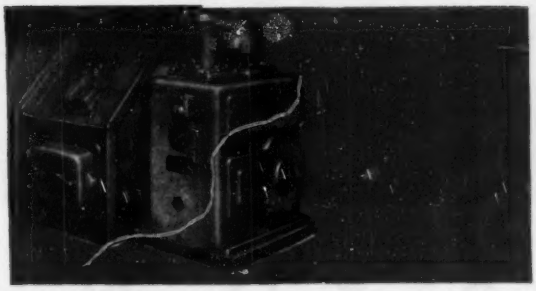
STOKER CORPORATION, WORCESTER, MASS.

Boston Cincinnati New York Charlotte Philadelphia Atlanta Denver Washington New Orleans Salt Lake City Buffalo St. Louis Los Angeles Pittsburgh Kansas City Portland Cleveland St. Paul Seattle Detroit Tulsa Chicago Houston

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS



* First three months, latest available figures at time of ad preparation.



THE GRATE DRIVE The Riley grate drive is a hydraulically driven ratchet drive, completely enclosed and automatically lubricated. This simple rugged drive operates with practically no maintenance and is not susceptible to damage in case of grate obstruction. No sprockets, chains or speed reducers are required.

BACKED BY OVER 50 YEARS OF EXPERIENCE There are over 50 years of stoker designing and manufacturing experience back of the Riley Traveling Grate Spreader Stoker, dating back to the two first successful makes of stoker—the Murphy Furnace and the Jones Underfeed Stoker. Riley has been manufacturing traveling grate stokers for over thirty years.

We believe it will pay you to visit some installations before purchasing traveling grate spreader stokers.

All of these Companies have ordered Riley Traveling Grate Spreader Stokers

Carbide & Carbon Chemical Company
Whiting, Indiana

Ohio Edison Company
Springfield, Ohio—two orders

Iowa-Illinois Gas & Electric Company
Iowa City, Iowa

Celanese Corp. of America
Hopewell, Virginia

Cliffs Power & Light Company
Ishpeming, Michigan

Iowa Public Service Company
Carroll, Iowa

Kennecott Copper Company
McGill, Nevada

General Electric Company
Richland, Washington

Garlock Packing Company
Palmyra, New York

Swift & Company
Baltimore, Maryland

E. I. DuPont de Nemours & Co.
Savannah River Project, South Carolina

Kaiser-Frazer Company
Willow Run, Michigan

B. F. Goodrich Company
Akron, Ohio

Utah-Idaho Sugar Company
Washington

Armstrong Cork Company
Lancaster, Pennsylvania

Pennsylvania Electric Company
Seward, Pennsylvania—three orders

Ohio Edison Company
Youngstown, Ohio

Ottertail Power Company
Crookston, Minnesota

Champion Paper & Fibre Company
Canton, North Carolina

Central Illinois Light Company
Springfield, Illinois

Monsanto Chemical Company
Springfield, Massachusetts

General Electric Company
Louisville, Kentucky

Gaylord Container Company
Bogalusa, Louisiana

John Deere & Company
Alladin, Iowa

Swift & Company
Charlotte, North Carolina

Brown-Lipe-Chapin Div.
General Motors Company
Elyria, Ohio

U. S. Gypsum Company
Oakfield, New York

Stokely Foods
Indianapolis, Indiana

Catalytic Construction Company
Fernald Project, Ohio

Sangamo Electric Company
Springfield, Ohio

University of Minnesota
Minneapolis, Minnesota

Rochester Municipal Plant
Rochester, Minnesota

City of Napoleon
Napoleon, Ohio

Corn Belt Power Co-op.
Humboldt, Iowa

U. S. Air Force Base
Limestone, Maine

City of Ames
Ames, Iowa

Alabama Electric Co-op.
Andalusia, Alabama

Jamieson Coal & Coke Co.
Farmington, West Virginia

Spokane Water Works
Spokane, Washington

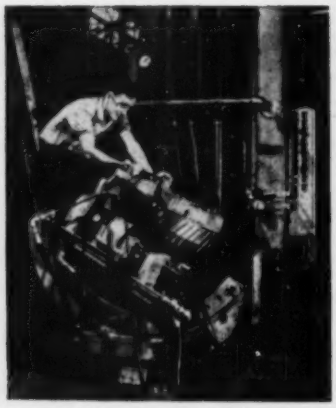
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

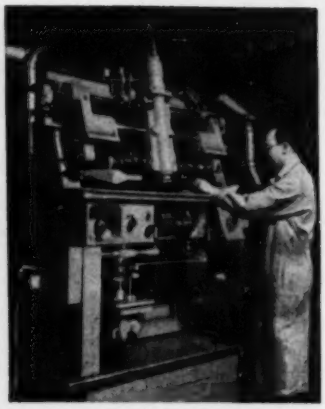
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

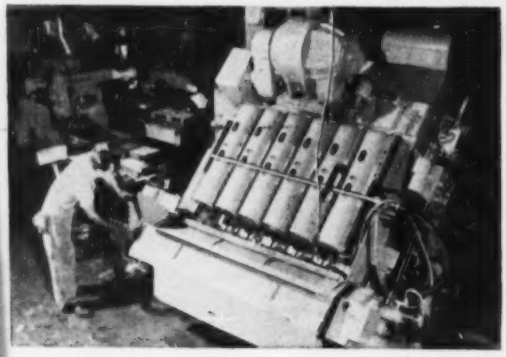
This accuracy check on turbine bucket dovetails is one of many quality controls.



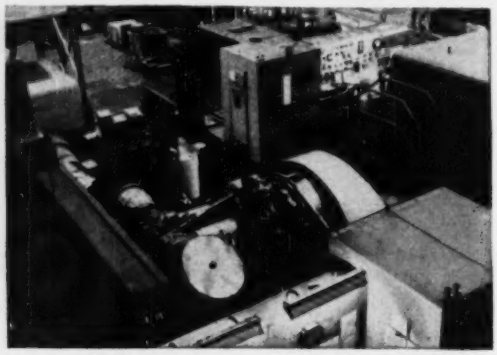
Automatically operated, this three-station broach cuts dovetails in compressor wheels.



An automatic polisher brings machined compressor blades to their final contour.



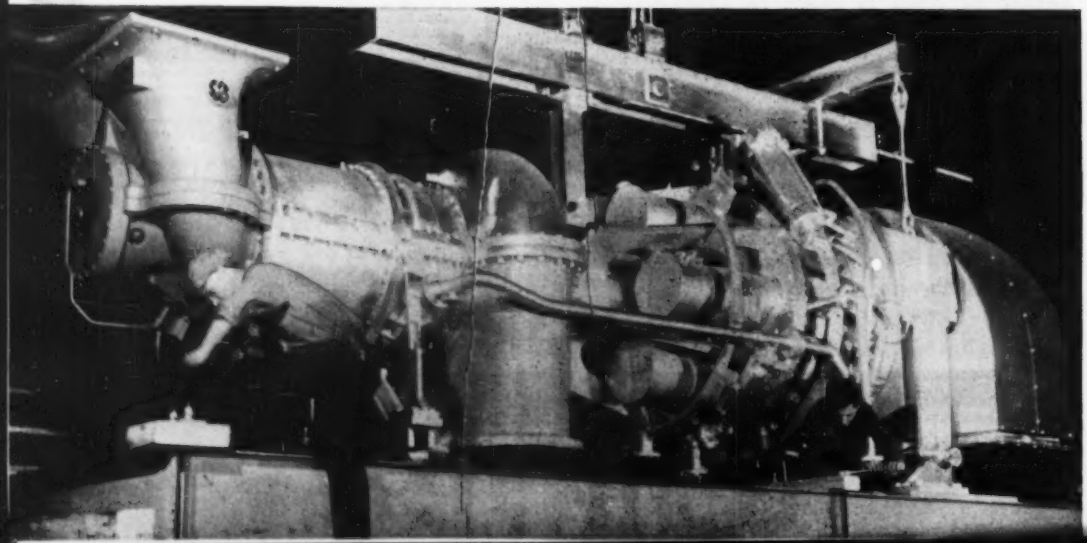
This machine simultaneously cuts six compressor blades or turbine buckets from blank stock to within 0.005 in. of finished dimension.



Testing includes checking of mechanical balance, performance, bearing operation and emergency and speed regulating governors.

General Electric's Gas Turbine Plant

ASSEMBLED UNITS LEAVING THE FACTORY ARE READY FOR PERMANENT INSTALLATION WITH A MINIMUM EXPENDITURE OF TIME AND LABOR.



One of the bays in General Electric's gas turbine plant at Schenectady, N. Y. Units are being assembled for locomotive, pipeline pumping, and power generation service.

Now Tooled for Continuous Production

With the recent addition of a number of specialized machine tools, General Electric's gas turbine manufacturing facilities are virtually complete. Production, testing, and shipment are on a regular schedule in the Schenectady, N. Y., plant. In fact, the 1952 order board calls for delivery of 46 units—six for freight locomotives, 34 for natural gas pumping stations, and six for power generation service in electric utilities. An even larger total will be produced in 1953.

Components for the 3500 kw simple-cycle, the 3500 kw regenerative-cycle, and the 5000 kw compound-cycle designs are in continuous production.

Recently, the first regenerative-cycle machine completed factory tests and is now being installed. This design, distinctive for its flexibility, is suitable for utility application in a variety of arrangements involving the combined use of both gas and steam turbine cycles.

Of particular importance are the refinements in manufacturing procedures which have come about as the result of operating experience with half a dozen units in customer installations. A large fund of data on fuels, design details, and performance has been accumulated.

Thus, in less than five years, a completely new development has become an established product. America's newest prime mover is making a significant contribution to the nation's over-all program for power expansion. General Electric Company, Schenectady 5, N. Y. 2354

GENERAL ELECTRIC

1,175,000 K.W.

Bechtel designed and built

Pacific Gas and Electric Company in 1948 awarded Bechtel Corporation a contract for its Contra Costa Steam Plant, now in service with 340,000 K.W. capacity.

California is growing so fast that in succession, Bechtel received contracts which virtually tripled the original order. Work is under way on

. . . the expansion of Contra Costa to 575,000 K.W., shown in the foreground, and

. . . the design and construction of a 600,000 K.W. steam plant at Pittsburg, 7 miles downriver.

Performance that earns repeat business is a reliable measure of an Engineer-Constructor's ability. Your inquiries about our resources for service will be welcomed.

BECHTEL

BECHTEL CORPORATION

BUILDERS FOR INDUSTRY

Los Angeles · **SAN FRANCISCO** · *New York*

NEW EXPULSION ARRESTER OFFERS HIGHEST SHORT-CIRCUIT CAPACITY

The new Westinghouse LX Arrester is designed to provide the *reserve of protection* needed as a result of increased concentration of power at distribution centers. Combining the expulsion principle with positive current-limiting action, the arrester operates successfully at locations of very high-bolted fault current—20,000 amperes at 3 kv!

Gaps and terminals shielded for safety

The LX Arrester is not only efficient but also completely safe. The series gap and the ground terminal are shielded by porcelain. With the polyethylene terminal cover, protection from exposure to live parts is complete.

Another advantage for the lineman is the easy voltage identification . . . each ring on the main porcelain body indicates a rating of 3 kv.

UNUSUAL DESIGN PROVIDES EXTRA PERFORMANCE BENEFITS

A skillful design involving the use of a spiral grooved filler produces an arc path of considerable length which sparks over at very low value. There is no "IR" drop of the kind encountered in valve-type arresters . . . the arc drop is the only voltage that appears across the arrester during the flow of surge current.

Westinghouse representatives have the full story on the LX Arrester. Ask for complete details or write for Descriptive Bulletin 38-150 to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Penna.

YOU CAN BE SURE... IF IT'S Westinghouse

LIGHTNING ARRESTERS

Rigid testing proves quality of Westinghouse high-voltage arresters

Because lightning arresters are a vital part in the protection of costly station equipment, Westinghouse tests every arrester to assure greatest reliability. Extensive production-line tests (shown here) insure the adequate performance of Westinghouse SV & LVS Arresters under the most severe operating conditions.

The heart of the arrester, the Autovalve® block, undergoes four separate tests; durability, hot-lightning, volt-ampere characteristics, and 60-cycle sparkover. They prove the ability of the arrester to divert lightning, arrest power-follow current and protect equipment. Proper assembly is checked by the 60-cycle sparkover test—and finally, the complete arrester is moisture tested.

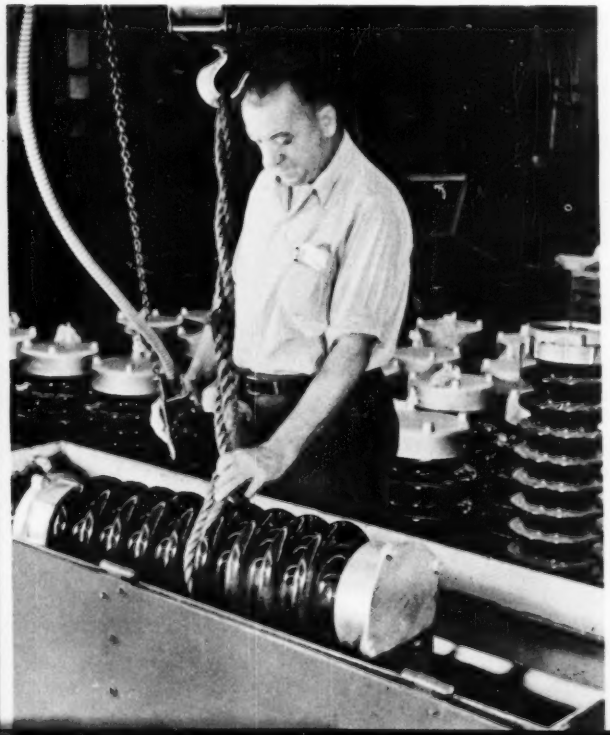
The excellent on-the-job service records of Westinghouse Arresters attest to this rigid method of quality control. It's another reason why you can be *sure* when you specify Westinghouse Arresters for any high-voltage application.

Durability test . . . A five percent sample of each batch of station arrester, Autovalve blocks receives at least fifty, 10,000-ampere long-tail discharges, superimposed on rated 60-cycle voltage, as a minimum quality requirement. If the 5% sample proves satisfactory, each block in the balance of the batch is . . .

Hot-lightning tested with two separate surges, superimposed on rated 60-cycle voltage, on a revolving test table as pictured above. For station-type blocks the current peak is 10,000 amperes. Line and distribution units get peak surge of 5,000 amperes. Series gaps are in the white rings above each cubicle.

Volt-ampere test assures that the "IR" drop of each Autovalve block is within the required limits. A 1500-ampere surge is used for this purpose. During the discharge, volt-ampere characteristics are observed on the screen of the cathode ray oscilloscope.

Sparkover test makes sure the 60-cycle breakdown and the internal assembly of every Westinghouse Autovalve Arrester are correct. It provides conclusive proof that the arrester will withstand its power voltage rating with considerable margin.



Moisture test . . . To assure that the complete arrester is absolutely moistureproof, each one is submerged in water and seal tested for leaks under 30 pounds per square inch of nitrogen gas pressure. Every arrester must pass this test without leakage. Westinghouse has conducted this test for 20 years.

YOU CAN BE SURE...IF IT'S

Westinghouse

LIGHTNING ARRESTERS

NOT ONE CASE OF MOISTURE TROUBLE REPORTED ON WESTINGHOUSE LV ARRESTERS IN 12 YEARS!

The excellent performance record of LV Arresters actually dates back to 1932, when Westinghouse introduced the "spun-on" metal cap. This feature licked the moisture problem permanently! So permanently, in fact, that it has not been necessary to alter this basic design in the past twenty years. The result; not one case of moisture trouble, radio interference or line lockout reported on the LV Arrester in 12 years!

Many other features contribute to the impressive service record of the LV Arrester. Its low, uniform sparkover—a result of pre-ionizing tips; its high surge capacity provided by preformed, pre-tested Autovalve blocks. Its protection against line lockout, assured by the drop-out feature.

Get Complete Information

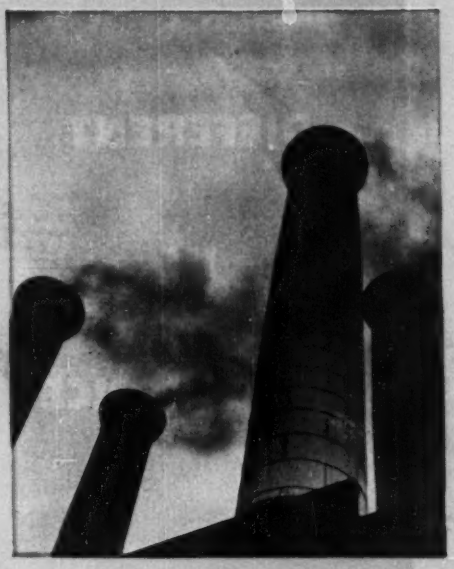
For complete information on Westinghouse LV Arresters contact your Westinghouse distributor or Westinghouse representative. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-60786

YOU CAN BE SURE... IF IT'S

Westinghouse

LIGHTNING ARRESTERS



"Major utilities now grant complete acceptance to inhibited turbine oils"

. . . and here's why so many of them choose **SHELL TURBO OIL**

Shell Turbo Oil exceeds every accepted specification for premium turbine lubricants. These are the notable qualities:

1. HIGHEST ATTAINABLE RUST PROTECTION

An effective *combination* of rust inhibiting additives goes to work at the source of rust formation. Rust problems are reduced to the very lowest level.

2. COMPLETE OXIDATION STABILITY

The anti-oxidant in Shell Turbo Oil has so far defied improvement! It provides outstanding oxidation stability and thereby minimizes sludge formation.

3. ANTI-FOAMING

The anti-foam agent now used is so effective that air entrainment can be tolerated for considerable periods . . . avoiding unscheduled shutdowns.

4. EXCELLENT EMULSION CHARACTERISTICS

Shell Turbo Oil's remarkable protection against rust and oxidation is attained with the minimum tendency to formation of water emulsions in service.

5. PROTECTION AGAINST WEAR

The inhibitive agents in Shell Turbo Oil *add* to the wear-reducing qualities of the specially refined oil itself, an extra margin of safety for the bearings during critical starting period.

For additional information on Shell Turbo Oil mail coupon.

SHELL TURBO OIL

SHELL

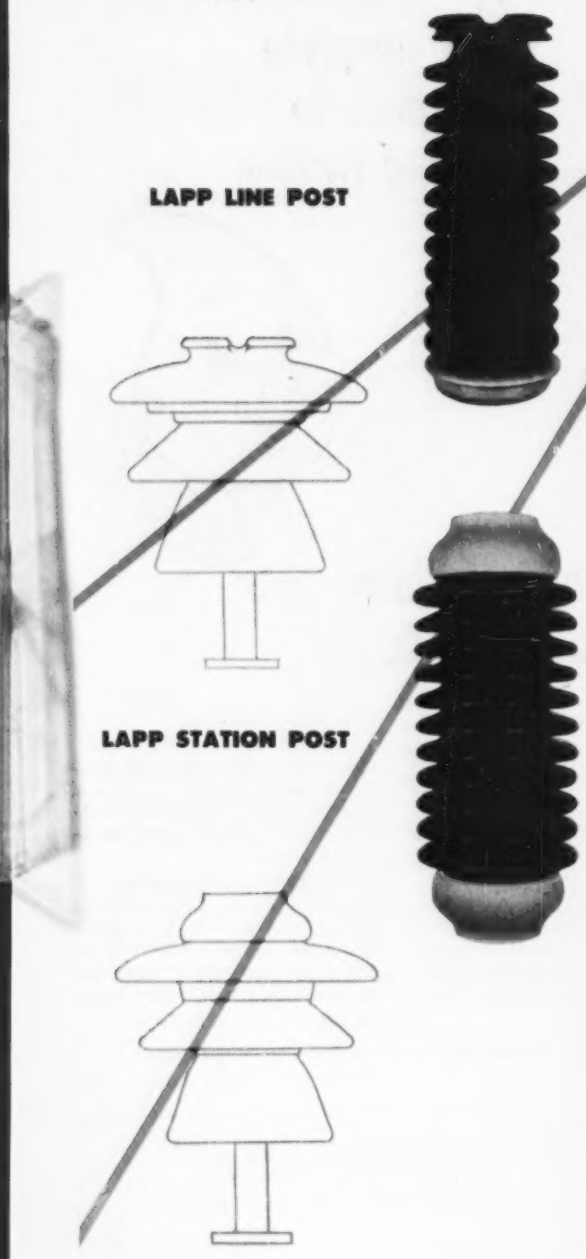
SHELL OIL COMPANY
50 West 50th Street, New York 20, N. Y.
or 100 Bush Street, San Francisco 6, Cal.

Please send information on Shell Turbo Oil.

Name_____

Company_____

Address_____



DIFFERENT IN APPEARANCE

. . . JUST AS DIFFERENT IN PERFORMANCE

You can't help noticing Lapp Line Post and Station Post insulators on lines and stations as you drive along the nation's highways. They look so different from conventional insulators! But the difference is even more spectacular in the maintenance and service record books of the companies operating them. The Lapp Post performance is that of a design which is strong in characteristics which make other insulators fail. The "differences" which can make a dollars-and-cents difference in your operating costs include .....

FLASHOVER

Multiple short sturdy petticoats keep the arc away from body of the insulator, are themselves less affected by rapid heating. If arc is severe enough, one or more petticoats break away, leaving body intact, arcover and leakage distance only slightly reduced.

MECHANICAL ATTACK

Similarly, short, stout petticoats protect against stones or bullets. But they are made to break away before sturdier post body can be damaged. (A smaller diameter target, too!)

CONTAMINATION

For service in contaminated atmosphere, Lapp Post Fog-Type design offers the dual advantage of uniform leakage path with consequent elimination of "hot-spot" shielded arc-starting areas, and "self-cleaning" in action of wind and rain.

PUNCTURE AND CRACKING

External flashover path same as internal puncture path—no puncture. Hardware externally attached, loads porcelain only in compression, eliminates cracking which comes from bursting forces of nested porcelain shells and metal pin.

RADIO INTERFERENCE

No live parts within insulator—terminals separated by full length of the unit. Corona does not form at operating voltages. Radio-free permanently, as a design conception.

PHYSICAL SIZE

Small diameter for easy hot-line work, economical double-arming. Extra height for extra clearance or use of shorter poles.

APPEARANCE

The "differentness" of appearance is itself an asset in public relations, particularly in handling of complaints of radio interference. New, modern, "different" insulators are evidence of company cooperation.

SERVICE RECORD

On hundreds of installations, records show that systems on Lapp Line Post and Station Post insulators have fewer outages, require fewer insulator replacements, less maintenance than systems on other insulators.

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, NEW YORK

Another Westinghouse Relay Development

Here's the greatest advance in Basic Relay Design in Half a Century!

The New CO Relay

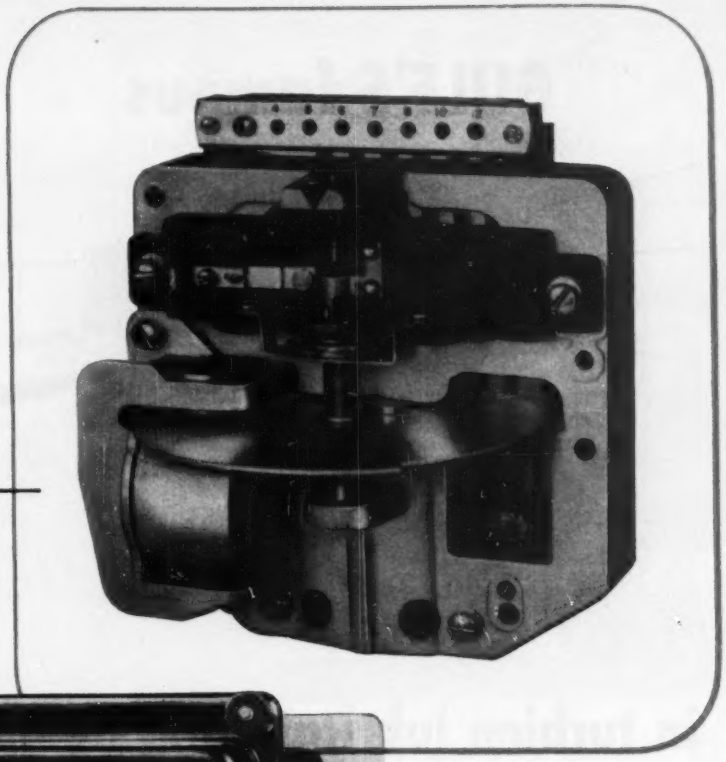
This new CO Relay brings you remarkable, new operating benefits in overcurrent relaying. The reason—the most significant advance in relay design since the introduction of the induction disc relay! We call it simply the "E" element—but look how it contributes to superior relay performance.

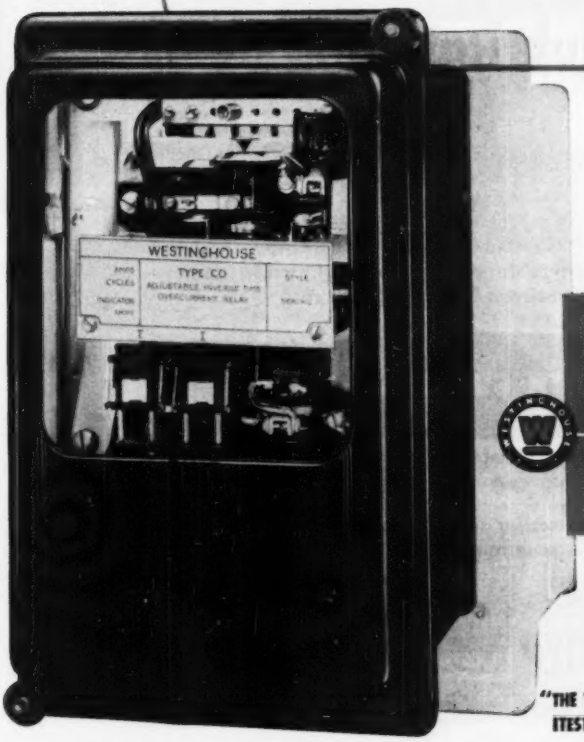
FOR GREATER ACCURACY . . . Magnetic plugs control the saturation characteristics to provide accurate timing over the entire operating range. Two independent adjustments provide accurate pickup at tap value of current for all disc positions. Micrometer adjustment of permanent magnet, by means of a "keeper" screw, which provides accurate adjustment without moving the magnet. Thus, four separate and independent tolerance controls, instead of only two as found on earlier relays, assure you of meeting time curves without compromise.

FOR GREATER FLEXIBILITY . . . A "Two-in-one time curve." Inverse and very inverse relays are identical except for calibration and, therefore, may be changed from one curve to the other (or intermediate curve).

FOR GREATER RELIABILITY . . . New positive-action tap block with "self-positioning" taps give metal-to-metal contact between tap terminal and tap plate. Other features contributing to reliable relay protection include: rigid one-piece, die-cast frame—cast alnico magnet—and non-geared design.

Ask your Westinghouse Representative to show you the new CO Relay—he'll be glad to go over it feature by feature with you—or request a demonstration by writing to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40410





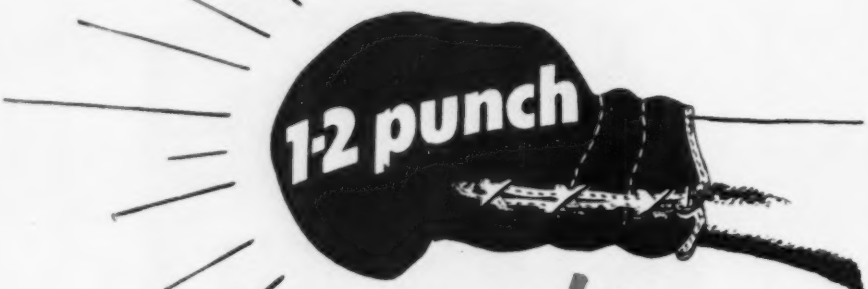
YOU CAN BE SURE...IF IT'S

Westinghouse

RELAYS

"THE TYPE CO OVERCURRENT RELAY IS AVAILBLE IN FLEX-ITEST OR STANDARD RECTANGULAR PROJECTION CASE."

GULF'S famous



prevents rust and deposits

in turbine lubricating systems

1. FLUSH WITH GULF TURBINE FLUSHING OIL

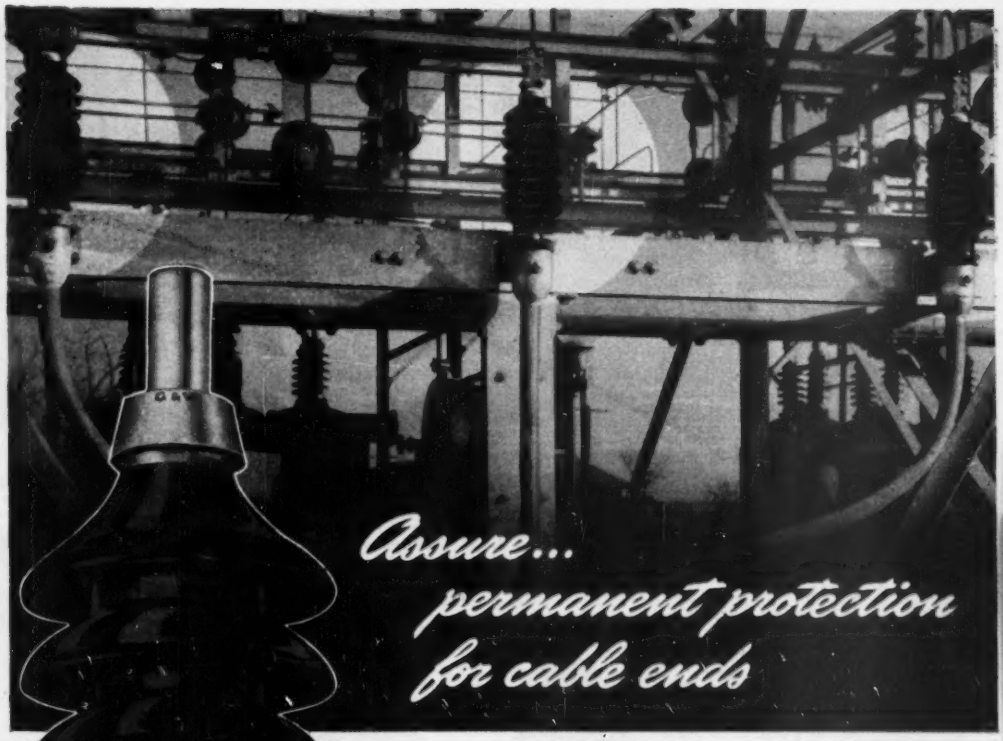
Removes grease-type slushing compounds. Carries away harmful abrasives. Protects against rust.

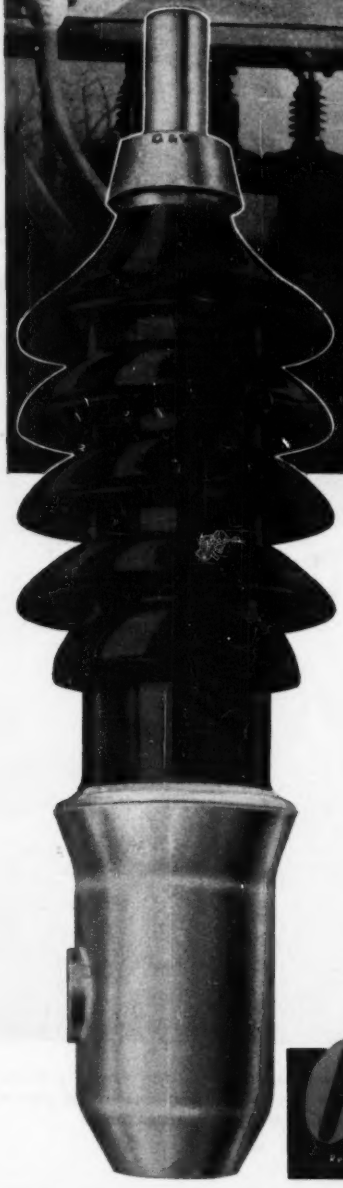
2. FILL WITH GULFCREST OIL

Maintains low neutralization number. Lasts indefinitely. Prevents rust on all oil-bathed surfaces.

Ask a Gulf Lubrication Engineer for additional information. Write, wire, or phone today. Gulf Oil Corporation · Gulf Refining Company, Pittsburgh 30, Pennsylvania.

GULF INDUSTRIAL LUBRICATION





SOLDERED PORCELAIN
TYPE "ST" POTHEADS

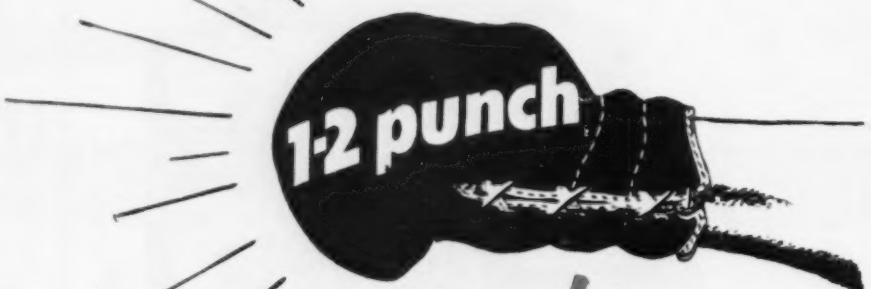
These potheads are factory assembled, with metal-to-porcelain soldered joints. This method (exclusive with G & W) completely eliminates the possibility of future trouble due to loosely gasketed joints. When these potheads are used, the responsibility for properly sealed joints rests entirely with our factory. Troubles due to aging, cold flow and permanent set of gasket materials are eliminated.

Since their introduction in 1940, type "ST" Soldertite potheads have achieved an excellent service record on gas filled as well as standard cables. Many ... utilities companies have standardized the use of t...

Bulletin No. AA50 give... ...d prices.
Bulletin No. A52 explo...
data on make-up as w...
Write for your copie...

G & W ELECT...
7780 DA...
Cable term...
Representatives in principal cities of U. S. &...

GULF'S famous



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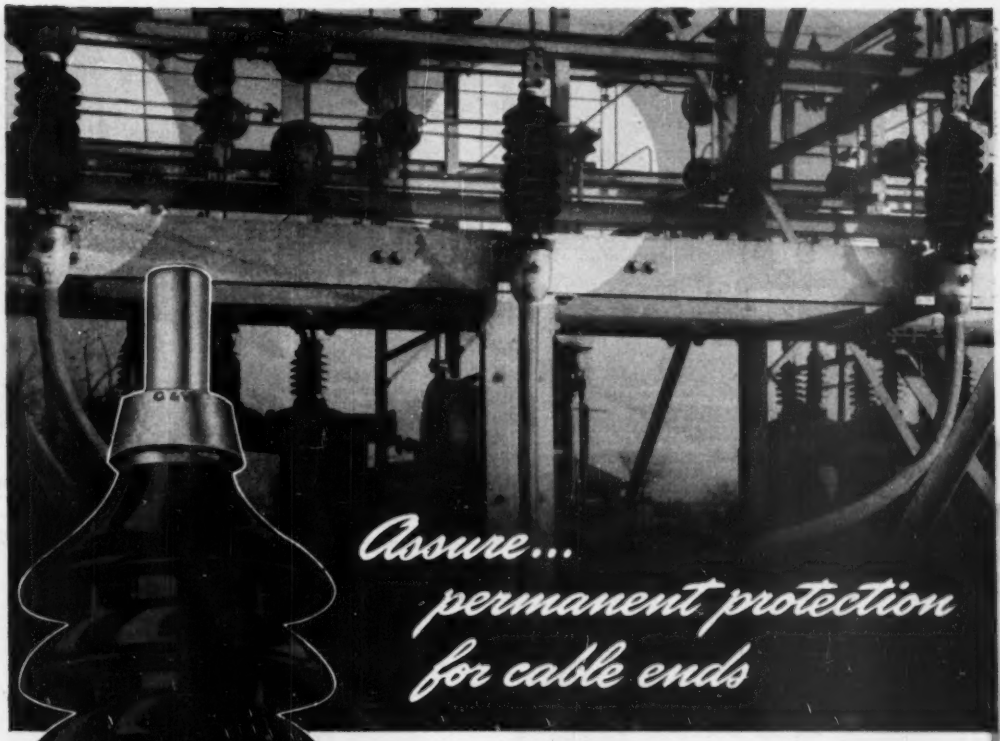

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Bulletin No. AA50 gives further information, data and prices.

Bulletin No. A52 explains the theory of stress cones and gives data on make-up as well as prices of material.

Write for your copies or ask your representative.

G & W ELECTRIC SPECIALTY CO.
7780 DANTE AVE., CHICAGO 19, ILL., U.S.A.
Cable terminating, connecting and sectionalizing devices
Representatives in principal cities of U.S.A. In Canada: Power Devices, Incorporated, Montreal

NEARING END OF FIRST PULL (609 feet) at Keene, New Hampshire, crew man is holding tension on reel by braking against reel flange. A G-E field man was on the job at Keene from start to finish to ease installation problems for the Public Service Company of New Hampshire.

WIRE AND CABLE FOR ELECTRIC UTILITIES

Experience stored at Bridgeport

HELPS ON CABLE INSTALLATION AT KEENE, N.H.

By making and helping to install thousands of products that power companies use, we have gained an unusual insight into the thorny problems you face every day. Our staff has become a clearing house for time-saving ideas and methods for the entire electric utility industry. What we have learned, working with electrical utilities throughout the country, may be the answer to one of your problems today.

For example: When the Public Service Company of New Hampshire installed 4150 feet of G-E 3-conductor 4/0 Awg, 15-kv pre-assembled aerial cable recently, a G-E field man conducted a school to explain most of the problems that would be encountered. The school utilized the experience of our entire Bridgeport cable staff—experience gained in helping with aerial cable installations where the problems were ice, wind, longer spans, or better appearance in residential areas. General Electric field men were able to supply time-saving ideas on routing the line through residential sections, on anchoring and terminating, and on other questions as they appeared. Altogether, they helped turn what could have been a rather difficult job into an almost routine installation.

LINEMEN of Public Service Company of New Hampshire dead-ending messenger. Officials of the Public Service Company said G-E field men helped them over many difficult situations.

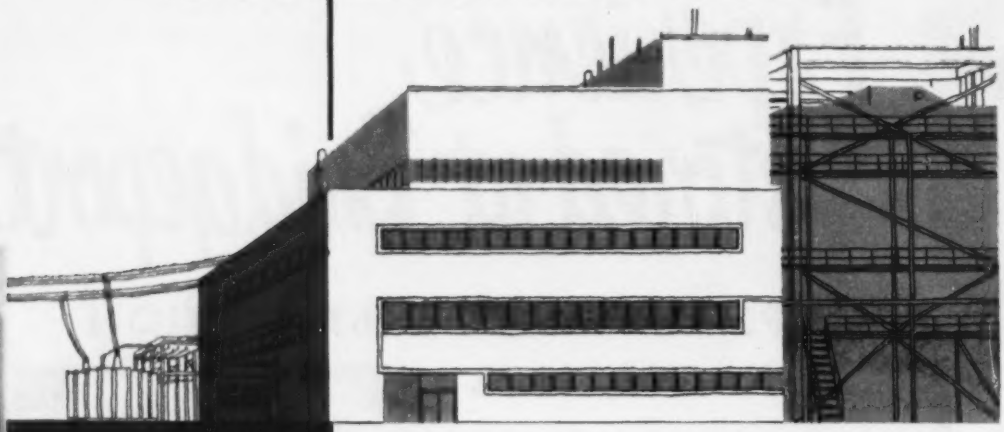
This same service is available to you when cable problems arise. A call to your G-E cable specialist is all that is required. He can put the G-E staff to work, probably save you countless hours of engineering and installation time. Section W34-627, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—

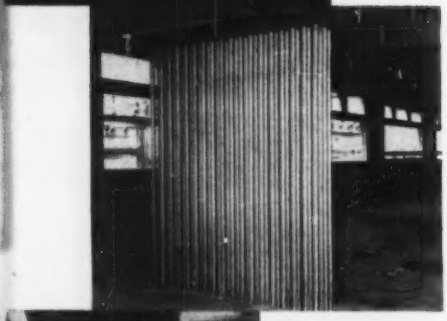
GENERAL ELECTRIC

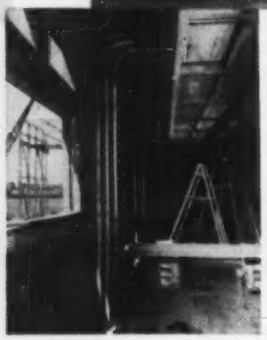
In Florida
at Jacksonville's New Power Plant

THEY'RE | EXPERTS IN HOT CIRCUITS



...THEY APPROVED SPANG® CENTRAL CONDUIT





Two-inch Spang Conduit on circuits for controlling and metering 69,000 volt switchyard.

Control and metering of 13,200 volt switchyard and transformer protection for one 15,000 KVA and two 37,500 KVA transformers is through two-inch Spang Conduit.

The men who designed the new South Side Generating Station at Jacksonville, Florida, are specialists in equipment for handling power . . . high voltage and low voltage. They designed for peak operating dependability around the clock, day after day.

Which makes particularly significant their approval of Spang Central Conduit . . . for all control systems and many other needs in this ultra-new power station. When power engineers approve an electrical product, *you can be sure it's good.*

That's why we urge you to standardize on Spang whenever you want the utmost in dependability. It's a quality-controlled conduit . . . made from carefully selected steel, formed under exact heat conditions, inspected constantly—manufactured to give exactly the right bending, cutting, and threading characteristics. All features that will cut your installation time and costs.

Be sure to specify Spang "Cenlaco", "Central Black", "Central White", "Central EMT" for a guarantee of year after year of trouble-free service. You'll find it will pay!

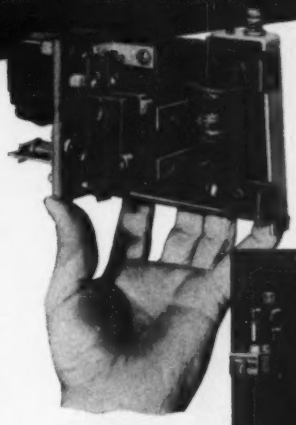
SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
PITTSBURGH 30, PA.
District Offices and Sales Representatives in Principal Cities

The Builders were:
Engineers & Architects: Reynolds, Smith & Hills, Jacksonville, Florida
General Contractor: George D. Auchter Company, Jacksonville, Florida
Electrical Contractor: Cleveland Electrical Company, Jacksonville & Atlanta

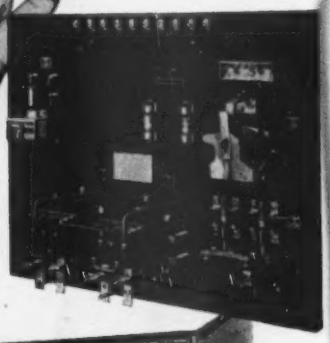
NON-STOP OPERATION SAFEGUARDED

by EC&M THERMAL-MAGNETIC OVERLOAD RELAYS

set at 90% to 110% full load current



¾ rear view shows independent thermal and magnetic tripping elements — both are adjustable. Relay is front-connected, removable as a unit from the mounting-base.



Type ZTM Overload Relay Panel with Time-Delay Under Voltage Protection feature is mounted in the lower compartment of EC&M 2300 volt Full Voltage Starters.

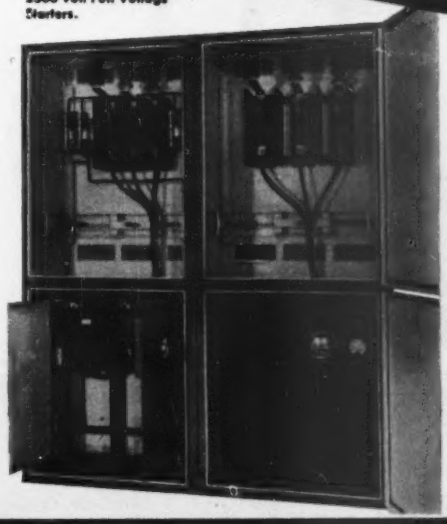
In a certain chemical processing cycle motor-drives operate up to six months without stopping. Continuous operation is essential until the product is completely processed and the machines cleared. Ambient temperatures are high.

To safeguard the insulation of these motors—by keeping temperature rise within safe limits—EC&M 2300 volt Motor Starters with EC&M NEW Type ZTM THERMAL-MAGNETIC Overload Relays were chosen.

These new Relays couple motor current directly to thermal action through a transformer for quick, positive response. Depending upon the motor load and ambient temperature, the thermal element of these Relays is adjusted from 90 to 110% Full Load Motor Current. Thermal reset time is short. Magnetic instantaneous operation minimizes damage under fault current conditions.

For improved motor protection, investigate EC&M THERMAL-MAGNETIC Overload Relays.

Write for your copy of Bulletin 1180-321.



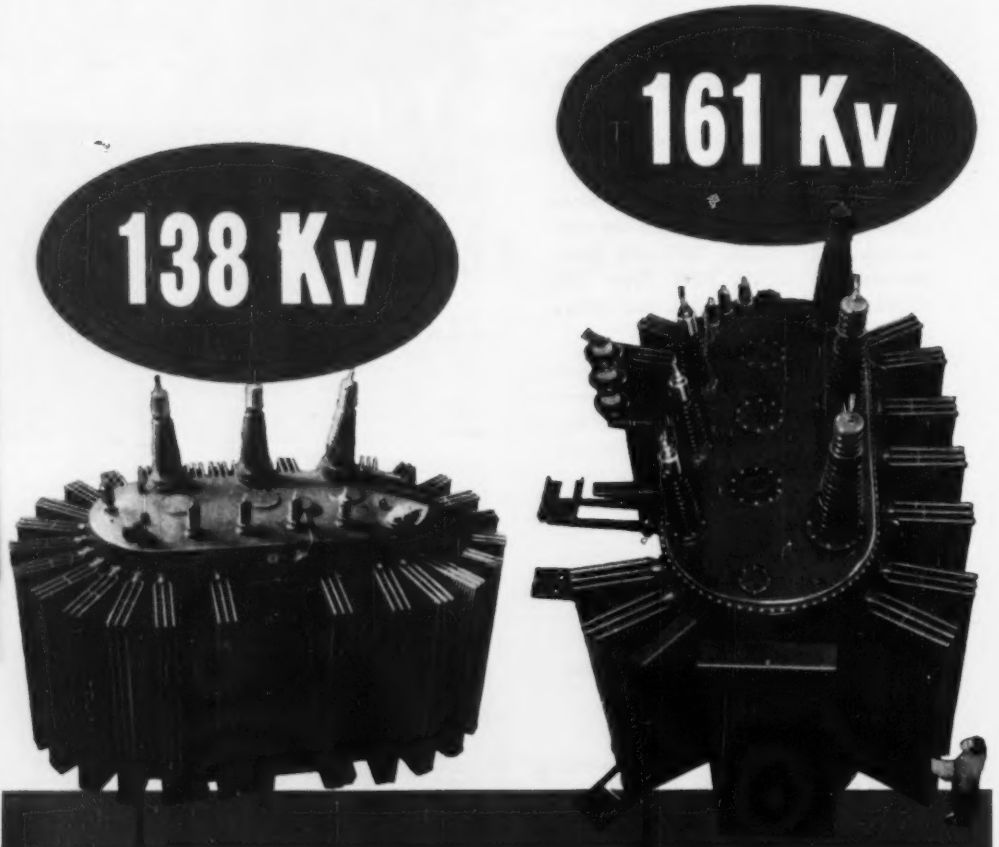
THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79TH STREET • CLEVELAND 4, OHIO

High Voltage POWER

by

Pennsylvania



37,500/50,000 Kva. 3 Phase, 60 Cycles, 132,000 Grd. Y—24,000Y/13,860 volts—6900Δ volts. Self-cooled/forced-air-cooled. Inert gas pressure system of oil preservation.

30,000 Kva. 3 Phase, 60 Cycles, 154,000 Grd. Y—115,000 Grd. Y—12,470Δ volts. Self-cooled. Inert gas-oil seal system of oil preservation.

TRANSFORMERS

230 Kv

Typical of the many higher voltage power transformers now under construction in the Pennsylvania plant are the recently-completed units pictured here. They represent single and three-phase transformers of core-form and shell-form construction.

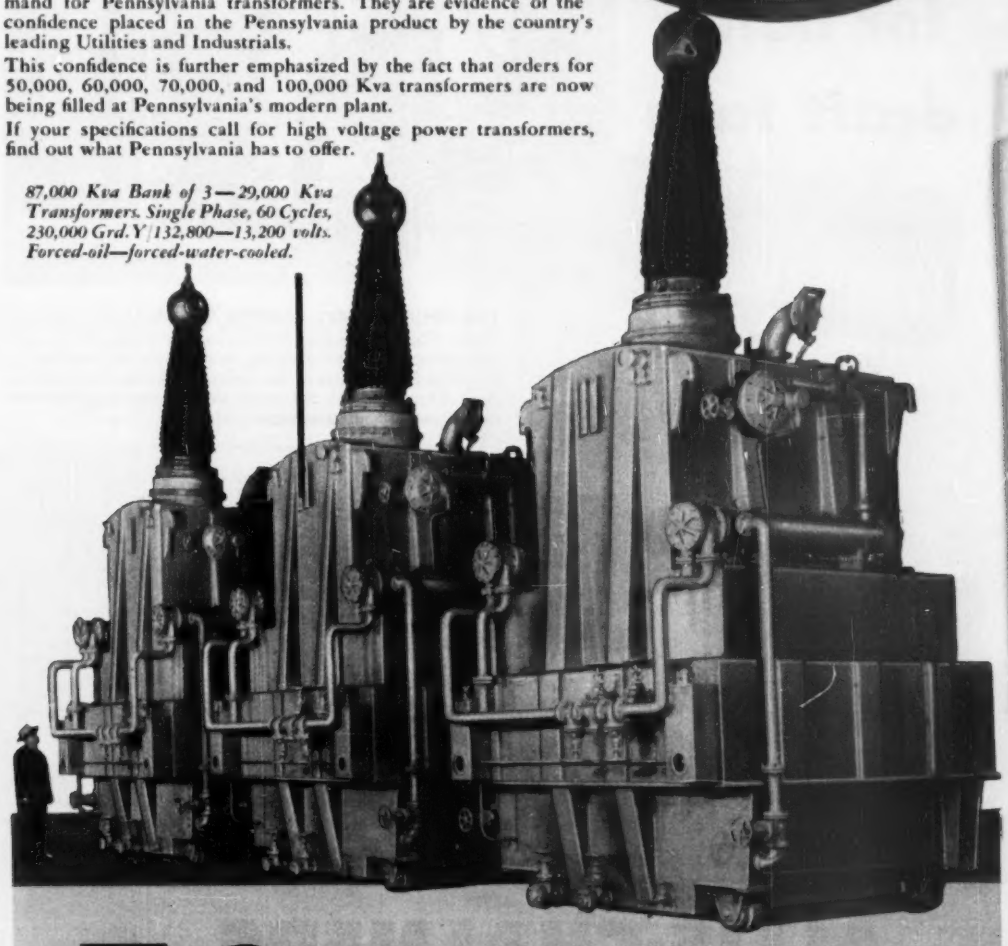
Each transformer is designed and manufactured with the extra care and precision which will pay dividends to the user in the form of outstanding reliability and low operating costs.

These units represent the growing acceptance and increased demand for Pennsylvania transformers. They are evidence of the confidence placed in the Pennsylvania product by the country's leading Utilities and Industrials.

This confidence is further emphasized by the fact that orders for 50,000, 60,000, 70,000, and 100,000 Kva transformers are now being filled at Pennsylvania's modern plant.

If your specifications call for high voltage power transformers, find out what Pennsylvania has to offer.

87,000 Kva Bank of 3—29,000 Kva Transformers. Single Phase, 60 Cycles, 230,000 Grd. Y/132,800—13,200 volts. Forced-oil—forced-water-cooled.



Pennsylvania TRANSFORMERS

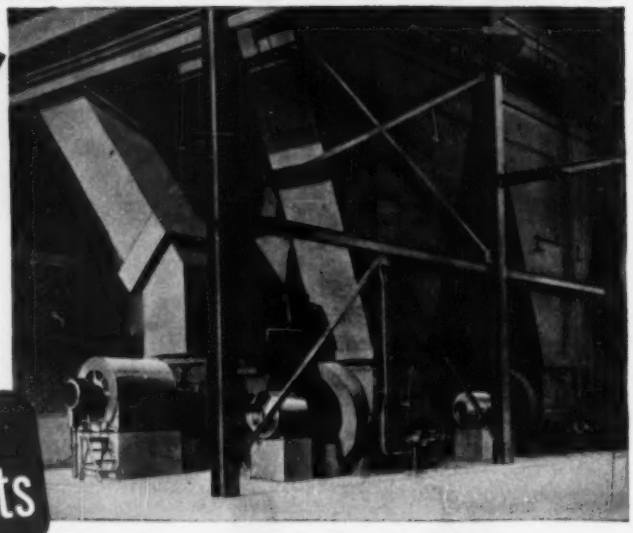
Pennsylvania TRANSFORMER COMPANY

CANONSBURG, PENNA. • *Greater Pittsburgh District*

STEPLESS SPEED CONTROL

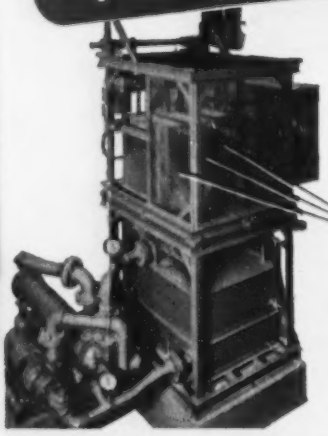
Engineered

for boiler draft fans

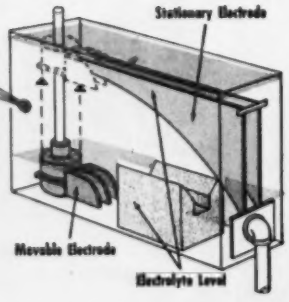


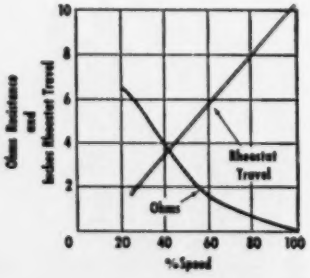
ALLIS-CHALMERS

Liquid Rheostats



FOR PROPER DRAFT CONTROL of boilers, Allis-Chalmers Liquid Rheostats are used in the secondary circuits of four 600 horsepower wound-rotor motors driving induced draft fans at the Edge Moor Station of the Delaware Power & Light Company. Direct coupling of fans and drive motors simplifies bearing alignment and maintenance problems.





TYPE 257 LIQUID RHEOSTATS can be placed in any convenient spot because only electrical connections are required. In this case, they are on the lowest floor of the power plant; the tube type TEFC drive motors are outdoors.

RHEOSTAT CELLS have both a movable electrode and a variable electrolyte level. The movable electrode is always completely immersed. Hot spots are eliminated by directing the flow of cooled electrolyte through the electrode plates.

STRAIGHT LINE SPEED CHARACTERISTICS are designed into these rheostats for each application. Needed resistance characteristics are built in by shaping the stationary electrode, and by fixing distance between electrodes.

ALLIS-CHALMERS

Allis-Chalmers Liquid Rheostats have but few moving parts . . . no arcing contacts. Electrodes can be actuated by electric, pneumatic, or hydraulic operators. Call your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin for leaflet 14S7544.

A-3721

Transmission Towers by AMERICAN BRIDGE handle nation's first 330,000-volt line

● The first leg of the American Gas and Electric Service Corporation's projected high voltage transmission network has been completed with the construction of a 63-mi. 330,000-volt, double circuit link running from Appalachian Electric Power Company's Kanawha River, W. Va., station to its Philip Sporn plant.

The towers for this record-setting line were designed and fabricated by American Bridge as the result of valuable data gathered from the A. G. & E. sponsored 500,000-volt test line at Ohio Power Company's Tidd plant, Brilliant, Ohio, in cooperation with other manufacturers of high voltage transmission line equipment.

These towers are approximately 150 feet tall and carry 6 conductors of 1,275,000 C.M., A.C.S.R. expanded cable (1.6"OD). The towers are designed for straight-line spans of 1700 ft.

The technical knowledge and field experience American Bridge has acquired in this and hundreds of other transmission line installations may be just the answer to your tower problems. Our engineers welcome an opportunity to figure with you without obligation. Just write to the nearest office listed below.

AMERICAN BRIDGE DIVISION, UNITED STATES STEEL COMPANY
GENERAL OFFICES: 525 WILLIAM PENN PLACE, PITTSBURGH, PA.
Contracting Offices in: AMBRIDGE · ATLANTA · BALTIMORE · BIRMINGHAM · BOSTON
CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DENVER · DETROIT · DULUTH · ELMIRA
GARY · MEMPHIS · MINNEAPOLIS · NEW YORK · PHILADELPHIA · PITTSBURGH
PORTLAND, ORE. · ROANOKE · ST. LOUIS · SAN FRANCISCO · TRENTON
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

DESIGN REDUCES FOUNDATION INSTALLATION COSTS. Important savings in time, labor, and materials were made possible through use of steel grillage earth anchors and variable leg extensions as shown above. Many other simplified installation and frill-free construction features are obtained through American Bridge designs.

USS

AMERICAN BRIDGE

UNITED STATES STEEL

Thompson Chemicals

FIRST NAME IN BRUSH KILLERS

EXTRA CREEP for EXTRA KILL with

LOW VOLATILE BRAMBLE-WEEDICIDE

Bramble-Weedicide contains H-31, the Thompson patented creeping agent because field tests prove it definitely steps up killing effect.

Woody growth control is also intensified by the use of low volatile pentyl esters. The molecular structures are absorption-rated to assure greatest herbicidal effect. For these reasons, Bramble-Weedicide is more effective and economical than older chemical controls..first choice of more and more utilities.

Whether you spray by truck, tractor, knapsack, plane or basal bark . . . specify Bramble-Weedicide.

Thompson manufactures many types of brush and weed killers. Write for helpful information on specific problems.

Thompson

other superior

WEED & BRUSH KILLERS

- **WEEDICIDES:** 2,4-D Esters and Amines
- **BRAMBLCIDE** 2,4,5-T Low Volatile Ester
- **PHYTOCIDE** } General Weed Killers
- **PENTA-WEEDICIDE** }

WHEN TO SPRAY BRAMBLCIDE

BRAMBLCIDE is the Thompson low volatile pentyl esters of 2, 4, 5-T fortified with H-31 for extra killing surface creep. BRAMBLCIDE is used for controlling mesquite, huisache, McCartney's rose, osage orange, prickly pear, oak, post, and black jack either by foliage spray or basal stem. Some utilities report that despite a slightly higher cost, (a smaller quantity is needed) it is the preferred herbicide for basal bark or stump treatment.

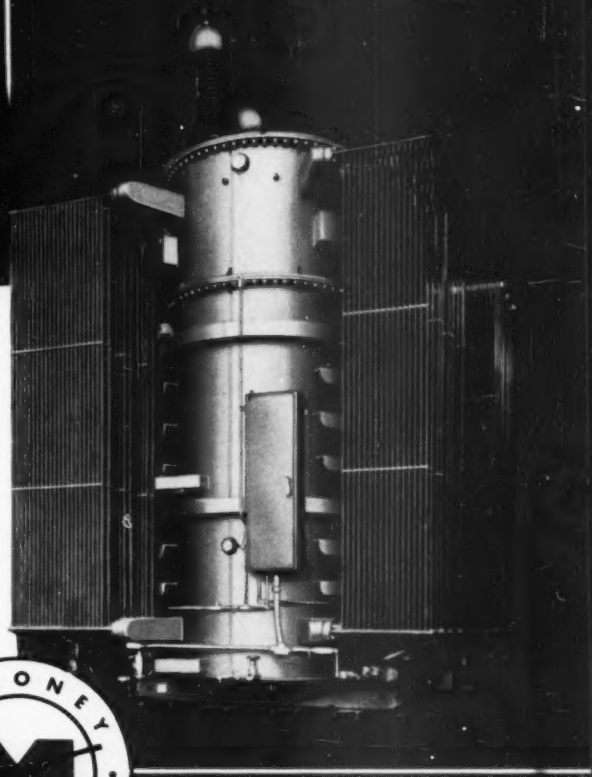
Send for helpful booklet:
HOW TO CLEAR RIGHTS-OF-WAY

Thompson **CHEMICALS CORP.**

St. Louis 3, Missouri
Los Angeles 27, California

MOLONEY PRODUCTS

These pages describe and illustrate the products of the Moloney Electric Company. For further information address your inquiry to nearest Sales Office or write direct to Moloney Electric Company.

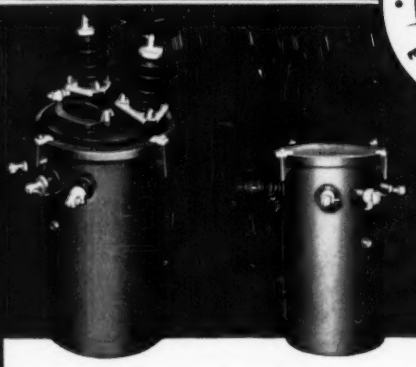


POWER TRANSFORMERS

The Moloney Electric Company manufactures Power Transformers of any voltage rating or capacity desired. Standard designs offer saving on single-phase ratings up to 5000 Kva and three-phase ratings up to 10,000 Kva in voltages from 2400 to 67,000 volts. These standard designs also permit quicker deliveries as a result of savings in engineering time.

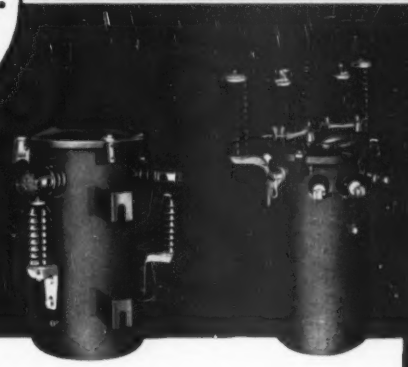
Power Transformers may be furnished with Askarel (non-inflammable cooling liquid) for use in locations where the use of oil might constitute a hazard.

MOLONEY ELECTRIC



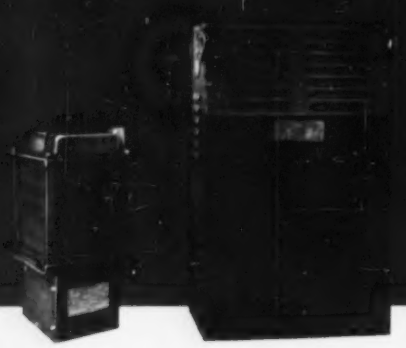
CONVENTIONAL DISTRIBUTION TRANSFORMERS

Manufactured in all standard single-phase and three-phase ratings up to 500 Kva in voltages of 67,000 volts and below. HiperCore construction on sizes up to 100 Kva, 15,000 volts and below, permits smaller size, lighter weight, increased efficiency and better regulation. Illustrated, small single-phase HiperCore Transformers. Distribution transformers are provided with standard taps and accessories in all ratings in accordance with ASA and NEMA standards.



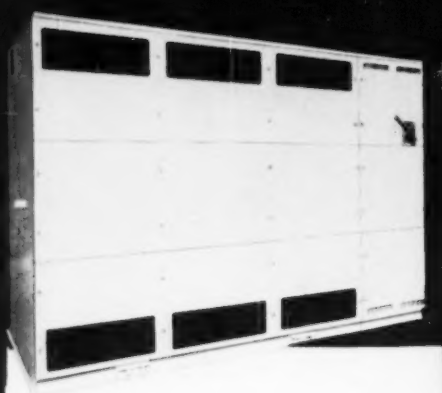
CSP DISTRIBUTION TRANSFORMERS

Completely Self-Protected (CSP) Transformers manufactured in ratings up to 100 Kva, single-phase, and up to 150 Kva, three-phase, in voltages below 15,000 volts. Equipment includes tank-mounted lightning arresters, internal primary protective links, tank grounding gap and secondary circuit breaker. Signal lights provided on all sizes 5 Kva and larger to indicate overload conditions. Signal light remains on till the circuit breaker is reset even though the overload may be of insufficient magnitude to trip the breakers.



DRY-TYPE, AIR-COOLED TRANSFORMERS
(600 volts and below)

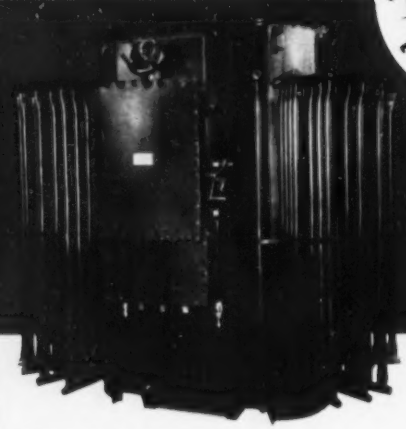
Moloney Dry-Type Transformers with primary voltages of 600 volts and below are manufactured in standard single-phase and three-phase ratings from 1.5 Kva to 300 Kva. 1½ to 10 Kva single-phase transformers are of Type DS weatherproof construction as illustrated at left. 15 to 150 Kva single-phase transformers are of Type DC construction as illustrated at right for indoor service only. Three-phase units are not illustrated here.



DRY-TYPE, AIR-COOLED TRANSFORMERS
(2400 volts and above)

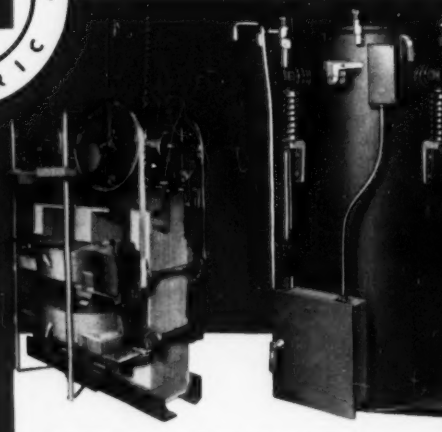
Moloney Dry-Type Transformers with primary voltages of 2400 volts or higher are made with Class B insulation (80° C. rise). Because of the absence of a cooling liquid, there is practically no maintenance cost when using air-cooled transformers. There is no liquid to require testing and conditioning and no valves, gaskets, or cooling tubes to maintain. Dry-Type Transformers are limited to a maximum voltage of 15,000 volts and to a maximum size of approximately 3750 Kva.

MOLONEY ELECTRIC



ASKAREL TRANSFORMERS
(Non-Inflammable—Liquid-Cooled)

Askarel Transformers contain a non-inflammable cooling and insulating liquid. This permits installation indoors without the expense of a fireproof vault. Their weatherproof construction also permits outdoor installation such as on roofs of buildings, in sidewalk vaults, in mines, and in other locations where the presence of oil-filled transformers might constitute a hazard. Askarel Transformers are available in the same ratings as oil-cooled transformers.



CONSTANT CURRENT TRANSFORMERS
(Including Packaged Units)

Moloney Constant Current Transformers are designed for use on series street or highway lighting circuits. They are available in Pole, Subway and Station Types.

Packaged Unit Constant Current Transformers are oil-cooled units for pole or platform mounting, which are equipped with complete, built-in, protective and control equipment.

All constant current transformers may be supplied with built-in capacitors for power factor correction.

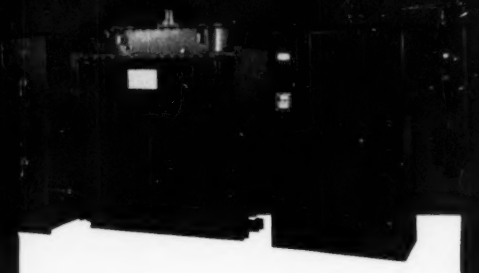
FEEDER VOLTAGE REGULATORS AND REGULATING TRANSFORMERS

Moloney Feeder Voltage Regulators and Regulating Transformers provide excellent voltage regulation through use of the Moloney Load Tap Changer. 10% plus and minus voltage regulation is provided in either 32-5/8% or 16-1 1/4% steps. Operation of the Load Tap Changer equipment on Feeder Voltage Regulators is completely automatic. Regulating Transformers can be arranged for either automatic control or remote-manual control, or a combination of the two.

LOAD RATIO CONTROL TRANSFORMERS

Power Transformers of all sizes are available with Load Ratio Control Equipment to maintain uniform voltage at the load by changing the voltage ratio without interruption of service. The Load Ratio Control mechanism is enclosed in an oil-filled compartment separate from the main transformer tank. The associated control equipment is housed in a dust-proof housing separate from both the main tank and the LRC mechanism compartment. Controls may be either automatic, remote-manual, or both.

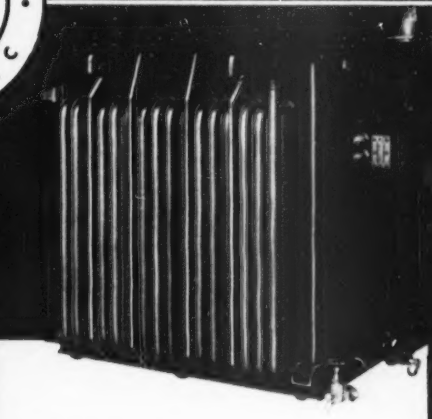
MOLONEY ELECTRIC



LOAD CENTER UNIT SUBSTATIONS

Load Center Unit Substations are available for either indoor or outdoor installation. Indoor types available with either air-cooled or Askarel-cooled transformers. Outdoor types available with either oil-cooled or Askarel-cooled transformers. Substations can be supplied with various arrangements of switches, fuses and low voltage switchgear.

Liquid-cooled units can be provided with Automatic Load Ratio Control equipment to maintain a uniform voltage under varying load conditions.



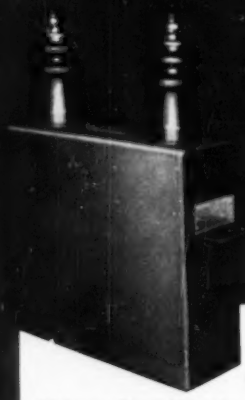
NETWORK TRANSFORMERS

Network Transformers are available in Submersible and Vault Types and with either oil or Askarel as the insulating and cooling liquid. These are compactly built transformers which take up a minimum of space in underground vaults.

Standard three-pole, three-position disconnecting and grounding switches permit isolating the transformer from the primary circuit. The low voltage end of the transformer is provided with a throat for attaching a network protector.

SUBMERSIBLE DISTRIBUTION TRANSFORMERS

Designed for underground service. Their construction permits operation while submerged for long periods of time. Wiping sleeves are provided for connection of lead-covered cables. The cover is solidly welded to the tank to insure a watertight transformer. Tanks and cooling tubes, provided on the larger sizes, are of heavy gauge metal to withstand the rigors of underground service.



CAPACITORS

Moloney Shunt Capacitors correct low power factor conditions by reducing reactive Kva. Improved power factor results in more efficient use of generator, transformer and feeder line capacity, and improves voltage regulation.

Individual capacitor sections are wound of aluminum foil and pure kraft insulating paper. Complete capacitors are vacuum-filled with Askarel, a non-inflammable insulating liquid. Solder seal bushings are provided on all Moloney Capacitors to prevent entrance of air or moisture. Standard ratings 15 and 25 Kvar, from 2400 to 13,800 volts.

MOLONEY ELECTRIC COMPANY

SALES OFFICES

Alexandria, Va. . . . . 401 Doniphan Bldg.
Allentown, Pa. . . . . 831 Linden St.
Amarillo, Tex. . . . . 616 Amarillo Bldg.
Anderson, S. C. . . . . 460 Tribble St.
Atlanta, Ga. . . . . 217 Whitehall St., S. W.
Birmingham, Ala. . . . . 1814 First Ave., North
Bluefield, W. Va. . . . . 2400 Fairfield Ave.
Boston 16, Mass. . . . . Statler Office Bldg.
Buffalo 3, N. Y. . . . . 564 Ellicott Square Bldg.
Butte, Montana . . . . . 604 Utah Ave.
Charlotte, N. C. . . . . 327 S. Church St.
Chicago 3, Ill. . . . . 100 West Monroe St.
Cleveland 14, Ohio . . . . . 914 Engineers Bldg.
Clovis, N. Mex. . . . . 906 Pile St.
Corpus Christi, Tex. . . . . 1318 Laredo St.
Dallas 1, Tex. . . . . 512 Thomas Bldg.
Denver 2, Colo. . . . . 512 Insurance Bldg.
Des Moines, Iowa . . . . . 308 E. Sixth Ave.
Detroit 2, Mich. . . . . 744 New Center Bldg.
Detroit 2, Mich. . . . . 17372 Livernois
Houston 1, Tex. . . . . 4411 Navigation Blvd.
Indianapolis 2, Ind. . . . . 2021 N. Meridian St.
Jacksonville, Fla. . . . . 3323 Timuquana St.
Kansas City 6, Mo. . . . . 522 Dwight Bldg.
Knoxville 17, Tenn. . . . . 1243 N. Broadway
Los Angeles 13, Calif.
Subway Terminal Bldg., 417 So. Hill
Memphis, Tenn. . . . . 1352 Madison Ave.
Minneapolis 1, Minn., 632 Midland Bank Bldg.
New Orleans 15, La. . . . . 4018 Thalia St.
New York 5, N. Y. . . . . 55 Liberty St.
Omaha 2, Nebr. . . . . 1104-5 WOW Bldg.
Philadelphia, Pa.
Commercial Bldg., 105 Forrest Ave. (Narberth)
Phoenix, Ariz. . . . . 1830 E. Madison
Pittsburgh 22, Pa. . . . . 1337 Oliver Bldg.
Portland, Ore. . . . . 1233 N. W. Twelfth Ave.
Salt Lake City, Utah . . . . . 314 Kearns Bldg.
St. Petersburg 6, Fla. . . . 1763 Ninth Ave., North
Syracuse, N. Y. . . . . 514 City Bank Bldg.
San Francisco 4, Calif.,
407 Holbrook Bldg., 58 Sutter St.
Seattle 1, Wash. . . . . 2603 Western Ave.
Shreveport, La. . . . . 630 Spring Ave.
Silver Spring, Md. . . . . 1410 Dale Drive
Wheeling, W. Va. . . . . 22nd and Market Sts.
Toronto, Ontario, Moloney Electric Co. of Canada, Ltd., 213-219 Sterling Rd.
Montreal 2, Que., Moloney Electric Co. of Canada, Ltd., Birks Bldg., Phillips Square

Light's Diamond Jubilee

Almost before we can turn around, 1954, the year of Light's Diamond Jubilee, will be upon us. That's a habit Father Time has. He lets us think there is no hurry then all at once he plunks down before us the "no longer coming but already arrived" occasion. Then he snickers as we scurry and scramble to face up to it.

This is our way of saying that if the 75th anniversary of Edison's invention of the incandescent lamp is to be observed in a manner measuring up to its importance, the industry better get rolling in preparation for it.

Quite properly, the beginning towards organization for celebration of Light's Diamond Jubilee is being made by the electric utilities. They are the core, the center, of the electrical industry. Considering the general human inclination to applaud a worthy undertaking rather than to pitch in and work at it, there is more than the thin edge of possibility in the thought that when 1954 comes the power companies will find themselves carrying the ball without a team on the field with them.

That will be bad. It will give some politician a chance to call Light's Diamond Jubilee a publicity stunt of the power companies, as Truman did Farm Electrification Week last year. And perhaps some ulcer-ridden editor will write of it as "a concocted 'news event' designed to give free advertising to electric light interests", as was done in reference to Light's Golden Jubilee in 1929.

Such possibility must be avoided. It can be avoided by enlisting every element of the electrical industry to help plan and carry on the celebration. They should be enlisted because the occasion will memorialize the beginning of the electrical age, not just the birth year of a "light in a bottle." Power suppliers, "business-managed," "publicly-owned," and "co-operative," should work together to make the occasion a success. Manufacturers of all kinds of electrical goods, not just makers of lamps and fixtures, should participate. Distributors and dealers selling appliances, radio, and television should contribute their efforts. Electrical contractors and consulting engineers should do their share.

All of these various elements of the electrical industry have their associations through which they can come together to assure that Light's Diamond Jubilee will be to the nation a fitting reminder of the man who gave it so much. It is up to the men now engaged in the preliminary work to bring them together—soon. Otherwise, Father Time will have the laugh on them as he has had so often over man's procrastination.

Progress Report

Evidence that the term, "Electrical Living" is penetrating into the public consciousness comes in a special section of the June 4 "Courier-Post", of Camden, N. J. It contains 16 pages, in which every use of electricity in the home is covered in stories and advertisements.

In content and treatment this feature section closely resembles the many other electrical supplements that enterprising newspapers all over the country have published from time to time. But there is a big difference.

Usually, such features are tied in with some local occasion—completion of a power plant, an electrical show, any event of electric significance. Also some element of the industry—the utility, electric league or other interested organization—is usually apparent as instigator or as close cooperator.

What makes the "Courier-Post" feature different from the rest and gives it the evidential value above noted is the fact that the electrical industry had nothing to do with it. The newspaper's promotion people decided by themselves, without outside prompting or consultation, that "Electrical Living" would be a good theme for a splurge. So they went ahead and did a mighty fine job.

Controlling Steam Temperatures

In the early days of superheated steam the temperatures were comparatively moderate and a relatively small portion of the total heat applied in the steam generator went into the superheating function. Now the superheat (and with it the later reheat) temperatures have gone so much higher that for 2,200 psi and 1,050/1,000 F the percent of thermal energy going into these functions is substantially more than 55% of the heat released in the whole boiler.

Not only, therefore, is the instrumentation for control of these high temperatures important on a bulk activity basis but also the basis that excessive temperatures encroach on the capabilities of the metals employed and that sagging temperatures are detrimental to efficiency and maybe maintenance.

Along the route a good half-dozen ways have been evolved to adjust the temperatures when they tend to be off. One is to mold the boiler proportioning as to tube and wall surface, another to install dampers, still another to desuperheat by sprayed water or contact with relatively cool surface. Condenser type of control came along and so did directable burners. More recently there has been a revival of gas recirculation to modulate the steam temperature. Many installations have two or more of these regulating means.

What seems not to be too well sensed is that the availability of these tools along with the more critical requirements of regulation have complicated the task of instrumental control to the stage where it has become more intricate than combustion control for the furnace space has needed to be. Of particular interest should be the fact that systems of instrumentation nevertheless have been devised no only for correlating the functioning of various combinations of the correctives but for getting semi-anticipatory adjustment and fast response.

In short, reluctance to accept high temperature and high pressure for the new power plant lest the instrumentation be less trustworthy than the alloys in the pipe, tubes, and turbine is hardly justifiable. Reheat has been confidently embraced as an economic tool and as an operating practicability. It can be accepted with equal assurance that it can be controlled with automatic instrumentation.

Advice from an Industrial Leader

"Now is the time, I think, to turn a spotlight wherever the school room, the newspaper column, the magazine page, the stage, or the lecture platform is used to preach socialism in the utility field. I am not recommending personal attacks on individuals; nor am I calling for censorship. This is a free country, and any individual has the right to believe what he chooses. But I am convinced that every unfair and uninformed attack on the concept of free enterprise in the utility field should be identified for what it is and accurately answered.

"Specific and immediate attention should be drawn to every call for nationalization of a utility enterprise, to every stated assumption that the interests of the investor-owned utilities are opposed to the interests of the American people, to every mis-statement on the cost and use of tax-subsidized electric power, to the hosanna that rises when government starts up a generator and the silence that reigns when investor-owned utilities start up a dozen."

These paragraphs were taken from a speech of Gwilym A. Price, president, Westinghouse Electric Corp., at the dedication of the Walter C. Beckford Station of the Cincinnati Gas & Electric Co. In themselves they are an editorial. We recommend them to the industry.

A New Emily Post

A new "Emily Post" has been written. It is called the "Code of Courtesy." There is nothing in it about dinner parties or weddings. But it does prescribe rules that a utility employee should follow to win the friendship of the customers for himself and the company. Here are the ten basic rules the booklet lays down:

1. Treat every customer, every fellow employee as you want to be treated in the same circumstances (the Golden Rule).
2. Be truthful. Build up confidence in your work.
3. Neither ignore nor evade a question. It is better to say you don't know than to bluff or make up an answer, especially if asked about company plans or rates. Say that you'll find out and then do so.
4. Never make a promise that you can't keep nor that involves another person without his knowing it. Having made a promise do all in your power to see that it is fulfilled.
5. Say "thank you" sincerely, in a clear pleasant tone—not gruff, nor short, nor perfunctory.
6. Remember the value of "please" when you make any request.
7. Smile often and show that you mean it.
8. Accept responsibility. Don't pass the buck. And don't hesitate to admit an error.
9. Do not contradict anyone or argue, for friendship was never made this way.
10. The best way to make a friend is to BE one, and the time to make friends is BEFORE you need them.

And the best way to appreciate the value of this little publication is to write to President B. F. Pickard, Interstate Power Co, Dubuque, Iowa, and ask him for a copy.

THE ELECTRICAL WEEK

Featured in the News

Electric power industry begins to feel the pinch of the steel strike (p 56) . . . Reappointment of Buchanan to FPC is favored by Senate subcommittee (p 58) . . . PCEA speakers stress need for selling at annual convention (p 59) . . . H. H. Magdsick is named to receive 1952 IES Gold Medal (p 60) . . . ASA president calls on American firms to show greater leadership in the field of international standardization (p 60) . . . Court rules Interior has claim on excess capacity of Idaho Power transmission line crossing public lands (p 62) . . . House subcommittee recesses hearing on Hells Canyon project (p 62).

• • •

Latest from Washington—Dr George L. Weil resigns as assistant director of Reactor Development Division of AEC. He intends to become a private consultant in nuclear reactor design and engineering, dealing particularly in problems of experimental nuclear power plants for industrial and private firms . . . Warrior River Electric Co-operative Association, Oneonta, Ala., seeks preliminary FPC permit for proposed water power project on Locust Fork of Black Warrior River in Alabama.

Southern Co plans to call a special meeting of stockholders in August to amend by-laws by increasing directors from 12 to 13 and provide for an executive committee. Company also plans to elect James M. Barry, president of Alabama Power Co, a director and chairman of the Southern Co executive committee.

Construction—Carolina P&L spins second 100,000-hp unit at Goldsboro steam plant . . . Southern Indiana G&E breaks ground for 40,000-kw steam plant on Ohio River just west of Yankeetown, Ind.

Labor—Ohio power and UWUA-CIO agree to 11¢ an hour hike for workers in Philo, Tidd, and Windsor Power plants.

Litigation—Superior Judge Fred Kemp rules that a Chelan County Public Utility District condemnation action against Washington Water Power's dam at Chelan may proceed. No action has been taken on a concurrent motion by PUD to have trial date set . . . East Kentucky Rural Electric Co-operative Corp wins legal fight to construct a $30-million generating plant at Ford, on Kentucky River in Clark County. Decision by Court of Appeals at Frankfort, upheld Franklin Circuit Judge William B. Ardery's refusal to send the case back to PSC. Commission approved construction of plant on Dec. 14, 1950. But Kentucky Utilities appealed to Circuit Court. Losing there, KU brought it on up to Court of Appeals . . . City of Sandpoint, Idaho, is seeking an injunction which will prevent Corps of Engineers from impounding waters of Pend Oreille River behind Albeni Falls Dam near New Port, Wash. Its petition has been filed in federal court at Boise, Idaho, where Judge C. A. Clark has set July 8 at Pocatello for hearing on why the injunction should not be granted.

Rates—Ohio Edison gets PUC approval to consolidate 157 old rate schedules into four new schedules in its rural areas which will mean an increase of $860,000 annually.

From East South Central—TVA has taken option on 1,200 acres of land in McCloud community, five miles south of Rogersville, as a site for 360,000-kw steam plant, Rep Albert Gore of Tennessee reports.

From Middle Atlantic—Metropolitan Edison will consolidate its Reading, Pa., headquarters and service centers at an operations headquarters to be built north of city.

From South Atlantic—Instead of levying higher property assessments, Jacksonville, Fla., City Council is considering imposition of 10% tax on utility bills.

From the West Coast—A design for a completely sealed subway transformer under nitrogen pressure and for ratings up to 167 kva is being pioneered by California Inter-Utilities Underground Standards Committee. Design will eliminate gasketed handhole to stop breathing. Several manufacturers have indicated a willingness to build such units if demand is great enough . . . Striking steelworkers at Seattle have permitted shipment of steel for construction of towers on power lines at Hungry Horse Dam in Montana; and angle irons for Bonneville Power Administration at Sommers and Missoula, Mont.; and for transmission line between Skagit power project and Seattle. Reason: It is costing the government thousands of dollars daily, Tom Kennedy, secretary of Seattle local, says in explaining union's unanimous vote in favor of it.

Oregon Building and Construction Trades Council is demanding speedy construction of Hells Canyon Dam on Snake River, the Klamath River power project of California-Oregon Power, the Pelton Dam of Portland General Electric, and "further development of Deschutes River."

In a precedent-shattering opinion by Ohio Attorney General C. William O'Neill, cities were given virtually a free hand in spending the revenues or profits of municipally owned public utilities for any purpose. Reversing numerous opinions of former attorney generals dating back some 15 years, he held that cities may lawfully use a part of such revenues "to pay a reasonable portion of expense of the general administrative offices and departments of the municipality which in any way contribute to the operation of the utility."

Frederick S. Blackall, Jr, president and treasurer of Taft-Peirce Manufacturing Co, Woonsocket, R. I., is nominated as president of American Society of Mechanical Engineers for 1953.

Congratulations—Kenneth C. Lasseter, general superintendent of Savannah E&P, has been promoted to vice president in charge of operations.

WASHINGTON COMMENT

JESSE MOCK

Within the next few months a series of critical reports on federal civil works policy will be filed with the House Public Works Committee. These reports will deal to some extent with various aspects of the government's electric power projects.

Although the recommendations come too late to be translated into any kind of legislative action by the present Congress, they will form a basis for future attempts to bring some uniformity to the government's helter-skelter civil works policy.

Since late March a House Public Works Subcommittee headed by Rep Robert E. Jones, Jr, Alabama Democrat, has been collecting the facts on which the reports are to be made. A series of public hearings and staff studies are filling several volumes. Already the subcommittee staff is commencing work on the final reports.

Three Items of Interest to Utilities . . . At least three questions of interest to electric utilities will be dealt with in the upcoming reports. Since they haven't yet been written, it is impossible to say what conclusions will be drawn or what recommendations will be made. However, from the record compiled it strongly appears the reports will cover cost allocations on multipurpose projects, cost estimates of federal construction agencies, and de-authorization of some government building programs.

The first of these, cost allocations, has been in dispute probably since the first multipurpose project was built. Major question from the power standpoint is what part of the total cost of such a project should be charged to the power generation facilities. This is of tremendous importance because the amount allotted to power form the power investment, and hence the rate base for federally produced power.

When asking Congressional authorization for a project, the constructing agency usually allocates a certain portion of the estimated cost to power production. However, when it comes time to sell the power, another agency takes over and makes its own cost allocation studies. Since federal power rates are based on studies by the marketing agency, they sometimes are lower than if based on original allocations.

One of the more extreme examples of this sort of double-entry bookkeeping is found in the rates provided for in a recent contract made by Southwestern Power Administration (EW, May 5, p 76; June 2, p 66).

The subcommittee is likely to recommend some sort of general cost-allocation policy that will continue throughout the building and operating phases of a project. There will be no hard and fast formula but what one person describes as a "backyard policy." This means the allocations will be limited but with a fair-sized area still left for administrative discretion.

High Cost Estimates Under Attack . . . Second of the practices expected to come in for sharp criticism is the cost estimates of such agencies as the Army Corps of Engineers and Bureau of Reclamation. Preliminary cost estimates of huge waterway jobs have often represented less than half of the final costs of these projects. If the estimates had been more accurate, it is likely that some of the projects would never have been authorized in the first place. Congress has frowned on cost estimates of the two agencies in question, but a thorough and fair analysis of these estimates is needed.

Third of the problems put before the subcommittee is de-authorization of hundreds of projects which have been on the books for years but on which no work has been done. The subcommittee may suggest some method of removing them from the books. This would considerably reduce the "backlog" of projects which are charged to the Corps of Engineers.

All of these problems are ripe for legislative consideration, but under the usual procedure the Congress coming in next year will have to begin the job anew. This means tossing aside much of the work done by the Jones committee.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Cable duct entrances to and exits from metal-clad equipment should be thoroughly sealed to prevent "breathing" of moist air particularly if the equipment is on a fluctuating load cycle.

Caesium may be feasible as a material for low voltage rectification. However, it is somewhat corrosive and injurious when handled.

Exaggerating load duties of apparatus in stipulations to manufacturers with a motive of eliciting generous capabilities may be as unhealthy as exaggerating one's physical ills to induce the doctor to prescribe more potent medicine. Moral—don't be a design hypochrondriac, know today's dependabilities.

Control circuits are open-circuited but energized most of the time. Failures of early pvc control cables have been attributed to endosmosis at the negative dc lead.

Garbage disposal units add to the demand for water but fortunately the use is not rated as consumptive—it can be used again after treatment.

Chestnut poles still constitute 40% of the total on one Eastern utility system.

Class H insulation should move up into the larger ratings of transformers as fast as is feasible.

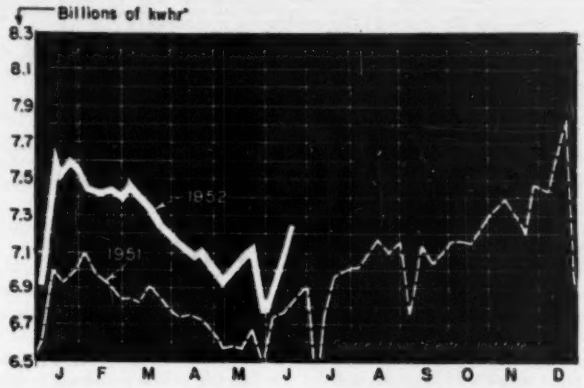
Arm contacts are three-fourth as frequent causes of linemen's accidents as hand contacts. Argument for rubber sleeves.

Capacitor pad thickness of 2.5 to 3.5 mils has a satisfactory ionization level and permits use of thicker and less costly papers.

Tinned connectors can be used on either copper or aluminum conductors with assurance that galvanic corrosion is not likely to occur.

Extruded insulation is more likely to permit eccentric migration of the conductor than wrapped layers.

STATISTICS



Output Week Ended June 21—7,254,058,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
June 21	+6.1	+1.6	+3.4	−2.0	+6.9	+14.6	+19.8	+10.4	+7.7	+5.3
June 14	+5.6	+0.1	+2.2	−1.9	+7.7	+14.3	+18.9	+11.8	+7.2	+3.5
June 7	+4.0	+2.2	+1.9	−2.2	+3.3	+13.1	+6.9	+7.0	+4.0	+6.5

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Loads (Million Kw)	Mar.	66.5*	66.9	61.4
Capacity (Million Kw)	Apr.	76.74	76.34	70.90
Production (Billion Kwhr)	Apr.	31.51	33.04	29.29
Hydro		9.96	10.44	9.01
Fuel		21.55	22.60	20.28
Fuel Consumption				
Coal (Million Tons)	Apr.	8.05	8.84	7.88
Oil (Million Barrels)		4.20	5.22	4.81
Gas (Billion Cu Ft)		66.50	57.39	58.84
Sales (Billion Kwhr)	Mar.	29.03	29.08	26.77
Residential		8.32	8.51	7.35
Commercial		4.85	4.87	4.44
Industrial		13.98	13.82	13.12
Other		1.87	1.88	1.86
Net Income Class A & B Companies ($ Million)	Apr.	75.90	82.65	70.64
Estimated Dec. 52 Peak (Million Kw)*	Mar.	80.4	80.5	78.2
Kwhr per Residential Customer (12 Month Average)	Mar.	2,053	2,037	1,882
Revenue per Kwhr Residential Service (12 Month Average)	Mar.	2.79¢	2.80¢	2.86¢
Canadian Production (Billion Kwhr)	Apr.	5.03	5.22	4.90

Business Statistics

FRB Industrial Production Index†††	May	215*	214	223
Gross National Product Annual Rate ($ Billion)	1st Qtr.	339.0*	334.6	319.5
E. W. 5 Industry Production Index	May	116.8	118.8	122.0
ENR Construction Cost Index††	June	117.8	116.8	113.7
BLS Consumer's Price Index	May	189.0	188.7	185.4
NEMA Insulation Materials, Sales Index†	Apr.	545	536	626
NEMA Electric Appliance Sales Index†	Apr.	221	278	326
NEMA Household Refrig. Sales Index†	Apr.	133	163	242
Metal prices (June 24)				
Copper, Conn. V., lb		$ .24½	$ .24½	$ .24½
Lead, N. Y., lb		.16	.15	.17
Zinc, prime Western E. St. Louis, lb		.15	.16	.17½
Tin, Straits, qual. N. Y., lb		1.21½	1.21½	1.06
Aluminum, ingot, base price		.19	.19	.19
Nickel, base price		.56½	.56½	.56½
Steel, billets, Pitts., ton		56.00	56.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		45.00	45.00	45.00

* Estimated. † 1936=100 †† 1949=100 ††† 1937-39=100 (Unadjusted)

Construction Cost Index A Valuable Tool

Many and varied uses have been made of the Engineering News-Record construction cost index by contractors, engineers, architects, accountants, insurance companies, bankers, public officials, and corporation financial officials.

Cost indexes are invaluable for rough, speedy, preliminary estimates or testing the overall results of detailed estimates. They are widely used by engineers to judge the reasonableness of contractors bids before awarding contracts and to project known plant construction costs of a given date to cost levels prevailing at the time for which a new plant estimate is needed.

The index is a useful guide to adjust property valuations. It has been used for operating escalator clauses in periods of rapidly rising prices to protect contractors bidding on new construction and to adjust unit prices of work shut down because of the war.

Increase in the replacement cost of buildings requires increased insurance to provide complete protection. Cost indexes may be used in adjusting insurable values.

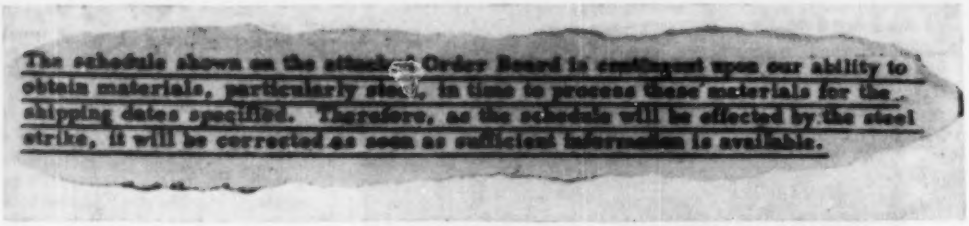
Engineering News-Record construction cost index was designed to indicate the basic trend of heavy construction costs.

A hypothetical block of construction requiring 6 barrels of cement, 1,088 board feet of lumber, 2,500 lb of steel, and 200 hours of common labor is used to measure this trend.

During June, for example, the 1949 = 100 index stands at 117.8. This indicates that this hypothetical block of construction will cost 17.8% more than it did during 1949. The index is however designed so that the base year may be shifted at will.

Because the index was designed to indicate the basic underlying trend of construction cost, materials were used that were least influenced by local conditions. These materials, steel cement, lumber, were also selected because they promised the most stable relation to the whole economy and to its price structure.

The index does not adjust for labor or job efficiency, materials availability, competitive conditions, management, mechanization, or other "intangibles" affecting construction costs.


The schedule shown on the attached Order Board is contingent upon our ability to obtain materials, particularly steel, in time to process these materials for the shipping dates specified. Therefore, as the schedule will be effected by the steel strike, it will be corrected as soon as sufficient information is available.

Excerpts like this from a letter of an electrical manufacturer to the NPA is one sign that the . . .

Steel Strike Menaces the Industry

The nation's electric power industry last week was feeling the first tingling paralysis of the steel strike.

In Detroit the delayed delivery of steel was throwing behind a construction schedule. There were other reports coming in to the government control agencies telling a similar tale. But the situation was still less serious than last year when the utilities were pinched by lack of materials, especially of non-ferrous metals and alloy steel products.

Government officials who keep tabs on the electric expansion program were willing to make these observations:

- There should be no delay in construction of generating facilities slated to come on the line this year as most of the equipment is already at the plant sites. Any "slippage" this year will be due to causes other than the steel strike.
- It will take months for steel mills to catch up with their delivery schedules even if the strike should be settled by July 1.

While the general attitude of government material control agencies is to "wait and see," some officials are busy preparing plans to minimize the effects of the strike on the power program.

Utilities May Get Larger Steel Quotas . . . On an operational level this will mean reshuffling of third and fourth quarter steel allotments to fit the supply picture and giving the defense and defense-supporting programs a proportionately larger share than they are now getting. Major losers under this plan would be the consumer durable manufacturers.

To do this the controllers will have to face the wrath of the less essential industries and their employees. In an election year votes mean a lot to the politicians. It should not be forgotten that political pressure in 1950 and 1951 softened the strict controls over materials which were first planned.

For the third quarter steel allotments for the industry's three control agencies were as follows: NPA's Engine and Turbine Division, 583,000 tons; NPA's Electrical Equipment Division, 594,650 tons; and Depa, 296,025 tons. There should be no trouble in securing this steel if the government control agencies want the industry to get it. The total amount is only one week's production. But the time required for fabrication could delay delivery into the fourth quarter.

No Manufacturers Down . . . The manufacturers are already feeling the strike's effects but only in spots. None reported any plans to shut down entirely. Westinghouse Electric Corp reported:

"The steel strike already is costing Westinghouse some lost production and delaying jobs here and there. We estimate that most of our plants can operate another three to five weeks (from June 18) before major production curtailments may become necessary."

General Electric Co on June 20 reported:

"Layoffs are beginning to hit the company as the result of material shortages due to the steel strike. At Pittsfield and Lynn, Mass., layoffs have occurred or work schedules curtailed. Pittsfield laid off 350 because of a silicon steel shortage, and 125 men at Lynn turbine plant were cut from five to four days a week. Reduced schedules will be put in effect shortly at the Schenectady turbine plant."

The company said that it had no plans to close any plants. But beginning with first manufacturing operations work will cease as steel runs out.

Steel Production Situation . . . Despite an increase in steel producing facilities, production of ingot steel was 192,000 tons less in the first five months of this year than in the corresponding period of 1951. This was due mainly to two work stoppages in May. But by the end of June "slippage" will be over 7 million tons. Because mills can produce more now than last year, actual loss will be over 9 million tons.

Total steel production capacity of the nation is close to 110 million ingot tons a year. About 25% of this is lost in fabricating. Scrap on certain items such as turbine and generator rotors runs much higher than the average.

Complicating the production picture is the ore situation. Many of the Minnesota and Michigan iron mines are also closed. The ore fleet is docked. This is cutting off about 3 million tons of ore a week. Because the steel plants along the Great Lakes must stockpile ore in summer (boats do not run in winter), a long strike could curtail production next spring. This would be very likely if the winter is long and hard.

What Will Happen in Late July? . . . Though manufacturers are keeping going by "chewing up" their inventories, eventually they will have to shut down. This applies to all manufacturers using steel. Some who make consumers goods, including most appliances, might even be happy because there are huge inventories of their products. But for the heavy manufacturing industries this is not so. They face a long shutdown.

With inventories gone they must wait for steel shipments. This may take as long as two months. Reason:

Steel rolling mills like to roll one product for three days or a week before changing their mills to roll another product. If a manufacturer needs several different sizes of or different forms, he may have to wait weeks until he gets them all. Furthermore, shipping takes time as most steel is moved by the railroads and not by truck.

Bad Business Ahead for Utilities? . . . Though Washington control agencies have been mostly concerned with plant expansion programs, the real threat to the utilities could be bad business conditions. The big steel producers make most of their electric energy. The smaller steel users who will be the next to go down are power buyers. Unemployment will cut also buying power. Other industries will suffer sooner or later as their inventories pile up. Then they too will have periods of shutdowns.

So far output has slumped but not too much. Output for the week ended June 21 was 7,254,058,000 kwhr, 6.1% above last year. But if business conditions worsen, power sales will slip and with them revenues.

And the "slippage" in plant construction. Look for it next year.

Detroit Edison Co Sets Up Nuclear Power Dept.

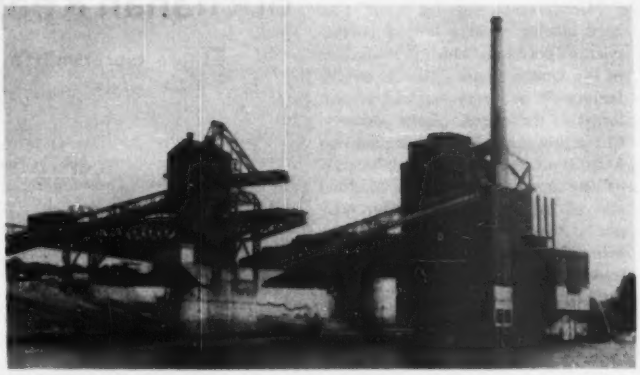
Detroit Edison Co has set up a Nuclear Power Development Department to coordinate the company's various activities in connection with its joint research program with Dow Chemical Co.

Detroit Edison and Dow have been cooperating under a contract with the Atomic Energy Commission to work out a basic engineering design for a nuclear heat power reactor of commercial usefulness.

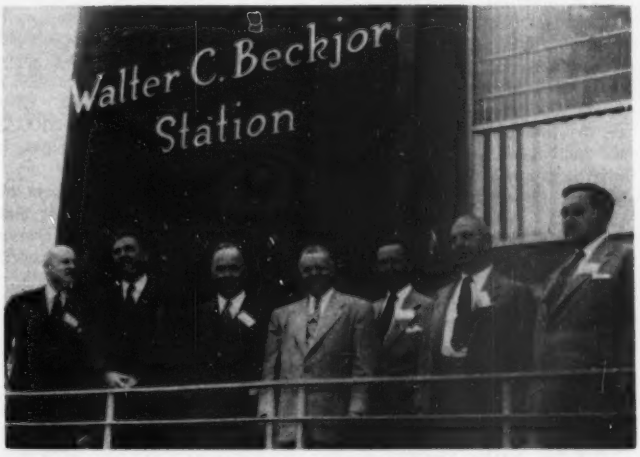
Coordinator of the new department is Harvey A. Wagner, assistant chief engineer of the utility's engineering department. Edward L. Nugent, assistant supervising engineer of construction engineering, has been named assistant coordinator.

General coordination of the research project with AEC, Dow Chemical, and other participants is the responsibility of consultant Alton P. Donnell.

Detroit Edison's Pres Walker L. Cisler emphasized the project is still in the study stage, with possibilities of a practical application probably some years in the future.



Cincinnati G&E's Beckjord Plant . . .



Principals at dedication (l to r): Dr Raymond Walters, University of Cincinnati; Gov F. J. Lausche; Walter C. Beckjord, Cincinnati G&E; Mayor C. W. Rich; Gwilym A. Price, Westinghouse; J. B. Santry, Combustion Engineering-Superheater; and Ludwig Skog, Sargent-Lundy

. . . and the Men Who Dedicated It

Cincinnati Gas & Electric Co's Beckjord Station was dedicated earlier this month at ceremonies in which top industrialists and government officials stressed the accomplishments of the free enterprise system.

The first unit of the station with a capacity of 100,000 kw is now supplying electricity to southern Ohio and northern Kentucky. Another 100,000 unit will be put into service next summer, and a third with a capacity of 125,000-kw will go on the line late in 1954. The three units will represent an investment of about $65 million.

In his dedicatory address Ohio's Gov Frank J. Lausche said, "Aside from the economic improvement projects of this type mean to the county, state, and nation, the construction of this new station showed the accomplishments that can be realized by the individual when he enjoys freedom."

Stresses Freedom . . . Viewing the new plant as a monument to the principles on which America was founded, the Ohio governor stressed freedom of the individual. He asserted that the nation will continue to grow so long as each person becomes the advocate of those principles.

In a warning against the invasion of the electric utility field by the federal government, Walter C. Beckjord, president of Cincinnati G&E for whom

the new station was named, said:

"Government has for some time been moving steadily toward government ownership of electric production in the United States. This is no idle fantasy. It is a very real and present threat to the electric power industry. In the past it has been contended that federal power projects were merely incidental to the necessities of flood control, navigation, and other purposes. Now, such contentions are being abandoned, and the emergency requirements of national defense are employed to justify the building of federal plants for the steam generation of electricity. Such plants are necessarily built with tax money provided by all of us, and their operations are tax exempt. So far as power production is concerned, this is statism, pure and simple. It is straight, undisguised planning for socialization."

Westinghouse Electric Corp's president, Gwilym A. Price urged that "every unfair and uniformed attack on the concept of free enterprise in the utility field should be identified for what it is, and accurately answered."

Says Maine's Power Needs Can Be Met by Utilities

William F. Wyman, president of Central Maine Power Co, told the New England-New York Inter-Agency Committee Maine's private utilities can be counted on to provide the state's future power needs.

He spoke at a hearing this month in Augusta, Maine, conducted by the committee. The committee in accordance with the Flood Control Act of 1950 and by direction of President Truman is making a survey of land and water resources and related matters in the New England area.

Wyman said his company and other Maine utilities are prepared and willing to meet the state's power requirements obviating the need for federal development of hydroelectric sites.

He declared hydro power must be supplemented by steam generation and water power developments gradually fitted into the overall picture.

Wyman denied water power means cheap power and said not all hydro sites can meet the competition of thermal capacity.

Federal development of hydro sites in Maine was also opposed at the hearing by Robert N. Haskell, vice president, Bangor Hydro-Electric Co.

Buchanan Reappointment Seen

Senate subcommittee favors nomination to FPC despite protests from several state regulatory commissions

Despite sharp protests from two state regulatory commissions, the Senate early last week appeared certain to confirm Thomas C. Buchanan for reappointment to the Federal Power Commission.

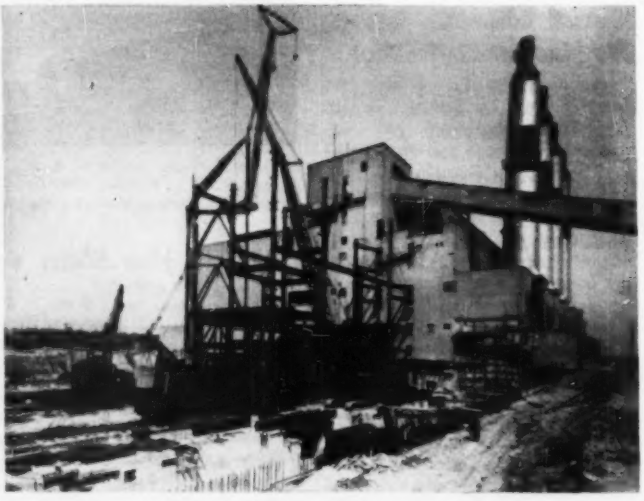
A three-man subcommittee of the Senate Interstate and Foreign Commerce Committee reported the nomination favorably to the full committee. It was expected that it would come to the Senate floor with full committee backing.

Support From Public Power . . . At committee hearings, Buchanan's support came from such public power groups as the National Association of Rural Electric Cooperatives. Clyde Ellis, executive manager of NRECA, appeared in favor of confirmation of Buchanan.

Opposition came mainly from Jeff A. Robertson, chairman of the State Corporation Commission of Kansas; William J. Murray, Jr, member of the Railroad Commission of Texas; and Warwick M. Downing, chairman of the Oil and Gas Conservation Commission of Colorado. All of these witnesses charged that Buchanan was bent on intruding on state regulatory authority. Their objections were based mainly on decisions made by the nominee in regard to natural gas matters affecting their own states.

States Rights . . . Typical statement was this one by Downing: "Like all others of his kind, he (Buchanan) seeks to destroy the rights of the states, to take from the people their right to local self-government, the very foundation of our national success."

During the hearing the three-man subcommittee headed by Sen Herbert O'Conor, (D-Md), listened to all comers. At the conclusion of the hearings, Sen Charles W. Tobey, (R-NH), said no evidence had been presented which reflected against the integrity of Buchanan.



Framework for Ridgeland Addition

Steel framework for the second half of Commonwealth Edison Co's Ridgeland Station is being put into place. The foundations and substructures for the addition recently were completed after 12 months' work. When the addition is completed for the winter of 1953-54, the station will have a capacity of 600,000 kw.

EXCHANGING VIEWS at PCEA meeting are (l to r) E. D. Sherwin, president, San Diego G&E; Vivian Kellems, president, Kellems Co; George Tenney, publisher, "Electrical West"

Selling Stressed at PCEA Parley

Speakers urge cooperation between utilities, manufacturers to promote electrical living and sale of appliances

Selling the electric industry to the public and better appliance promotion and salesmanship were stressed at the 34th annual Pacific Coast Electrical Association convention in Coronado, Calif., June 11-13.

In his keynote speech retiring PCEA president E. D. Sherwin, president of San Diego Gas & Electric Co, emphasized that we must not sell the industry short. Because of the present shortage of engineers, electric companies must do a better job of selling the advantages of utility employment to graduating engineers.

The industry again is being warned of the dangers of federal encroachment in the power field, Sherwin said, and this time it knows the dangers are real. He added the industry and all who believe in free enterprise have a selling job to do—not just to their friends but to all who need selling.

More Selling . . . We must sell more as we make more, said J. M. McKibbin, vice president Consumers Products Division, Westinghouse Electric Corp. To do this, he said, manufacturers must expand sales facilities as they increase productive facilities.

Sales activity, McKibbin continued, must follow the philosophy of progressive obsolescence if saturated markets are to be sold. Under this philosophy the new product outmodes the existing product by being more useful, more appealing, and right from point of view of cost. The primary responsibility of the utility industry under this philosophy, he said, is to promote electric living and effective use of electric appliances.

C. W. Theleen, manager of sales at Louisville, Ky., for General Electric Co, also urged increased sales activity to get the public to buy more electric goods. He said electrical manufacturers need the aid of the utility industry to coordinate promotion aimed at the domestic consumer if they are to sell their customers on a higher living standard. He added that his request for cooperation should be tempered with the vision of excess capacity in the near future.

Business Rise Seen . . . There is not going to be any "after-mobilization" period for many years, forecast Ralph H. Flynn, Electrical World publisher, because it will be at least ten years before defense spending drops as low as $25 billion annually. Business generally will rise during the second half of 1952, he added, and there's a good chance for a pickup in consumer durables.

Flynn declared the Wage Stabilization Board decision in the steel case will result in higher business costs almost insuring a squeeze on profits and therefore on funds available for equipment and plant purchases. On the brighter side, he said, the next Congress should reduce taxes on business, offsetting higher costs.

Looking at the next ten years, Flynn said the decline from 1951's industrial production level will be less than 10% at the low point in 1955. Beginning in 1956, he declared, there will be a very sharp climb in industrial production. Elimination of former high targets in defense spending should result in more uniform industrial loads, prevent runaway construction costs, and ease material supplies and the cost of money.

Sales Gains . . . Industrial sales will be about 169 billion kwhr this year, Flynn predicted, followed by slight gains in the next three years rising to 186 billion kwhr in 1956.

Although residential and rural sales were up 10% last year, he said, the rate of increase will decrease to 7% annually by 1954 with sales of 145 billion kwhr in 1956. Commercial sales are expected to settle down to about a 7% annual increase by 1954.

These increases indicate a total average annual gain of about 30 billion kwhr, Flynn pointed out. Even more heartening, he said, is the fact that by 1956 industrial sales will account for less than 40% while more profitable residential and rural sales will rise to 31% of total sales.

Production Rise . . . A 70% rise in production of electricity is the key to providing jobs, homes, goods, and services for the 10% rise in U. S. population by 1961, stated J. J. Huether, manager of utility sales, General Electric Co. It also will make possible the attainment of a gross national product of $390 billion in terms of 1951 dollars, he said. He predicted sales of energy will go from 318 billion kwhr in 1951 to over 633 billion in 1961 with a rise in installed capacity to 145 million kw.

This future expansion will depend on how well homes, factories, and communities can be persuaded to make maximum use of electricity, Huether pointed out.

George Gadsby, president of Utah Power & Light Co and past president of Edison Electric Institute, commented that the industry can meet today's needs much better with independent operating companies working together than under holding companies. He cited as examples the five New York utilities who are bidding

for redevelopment of the Niagara, the five companies which formed Electric Energy, Inc, and the 15 firms which propose to build a plant in the Ohio Valley to supply AEC needs.

Dunlap D. Smalley, vice president, Pacific Gas & Electric Co, was elected president of PCEA. New vice presidents are H. F. Hartzell, president Maydwell & Hartzell, and R. D. Moody, Los Angeles district manager, Allis-Chalmers Manufacturing Co.

Magdsick Cited

Nela Park engineer to receive Gold Medal of Illuminating Engineering Society

H. H. Magdsick of General Electric Co's Nela Park in Cleveland, has been named to receive the 1952 Gold Medal of the Illuminating Engineering Society, awarded for furthering the profession, art or knowledge of illuminating engineering. He will receive the award at the society's annual National Technical Conference in Chicago next September.

Magdsick has made notable contributions to illumination progress over a 40-year period. President of IES in 1929-30, he was among the first to be raised to the grade of Fellow when this grade of membership was established in 1945.

Following graduation from the University of Wisconsin in 1910, Magdsick joined the National Electric Lamp Association at Cleveland. He was made director of commercial engineering for GE's National Lamp Works in 1919, and became executive engineer following GE's consolidation with Edison Lamp Works.

Industry Prodded on Standards

President of ASA calls on American firms to show stronger leadership in field of international standardization

Roger E. Gay, president of Bristol Brass Corp, Bristol, Conn., and the American Standards Association, speaking at a meeting of the International Organization for Standardization (ISO) called on American industry to take a position of stronger leadership in the development of international standards.

In an address before 350 foreign and American delegates at the ISO banquet June 19, he said lack of such leadership is costing the country good will.

The banquet preceded two days of plenary sessions of the 33-nation ISO General Assembly meeting at Columbia University.

U. S. Trails Other Nations . . . "Most of the American businessmen I have talked with," Gay said, "have taken it for granted that American techniques and principles are being forcefully presented at international meetings. The simple fact is that the U. S. is following behind the enlightened leadership of other nations."

Gay stated that American industry is participating in the work of only 23 of the 76 ISO technical committees.

He said, "Committeemen have asked, 'Where are the Americans? America is our largest buyer, our largest seller. Will our decisions mean anything without them being here?"

Gay answered the question by pointing to whole-hearted participation in international standards work by certain American industries and by declaring U. S. industry has made greater strides forward in this area since the war than in the previous 50 years.

"All American industry today is conscious of this international effort, is curious about it, and is beginning to realize its potentialities for improving quality, increasing production, lowering costs and prices, and broadening markets to provide more goods for more people at less cost throughout the world," he said.

Union of Technicians . . . Dr Albert Caquot, French scientist who was wartime head of his country's Technical Aviation Services and who engineered such works as the erection of the statue of Christ overlooking the harbor of Rio de Janeiro, called for a union of technicians that will be a prelude to and the means of achieving union among the people of the world. Dr Caquot will retire Dec. 31 as president of the ISO. Dr Hilding V. Törnebohm, vice president and technical director of SKF Industries, Göteborg, Sweden, succeeds him for a three-year term.

Willard L. Thorp, Assistant Secretary of State for Economic Affairs, declared. "The unnecessary differences that confuse and confound relations between peoples can be gradually whittled away and ultimately eliminated." "There is general social benefit to all peoples," he said, "when certain understandable standards are established. . . . There is great benefit from developing common nomenclature, a common language of communication. . . ."

"These benefits," Thorpe concluded, "favor the interest of technical and engineering professional experts; they improve productivity; they extend the area of understandable communication; they benefit the consumer; and they make a contribution toward increased trade."

N. Y. St. Lawrence Plans Not Opposed by Truman

President Truman has indicated he will not oppose efforts of New York State to develop the hydroelectric potential of the St. Lawrence River.

Shortly after the Senate killed legislation to authorize American participation in construction of the St. Lawrence Seaway and power project (EW, June 23, p 15) Truman told a news conference it now was up to New York and Ontario to make the power available.

The New York State Power Authority's application to construct a 2.2 million-hp hydro project with Ontario was turned down by the Federal Power Commission in 1950. The authority appealed to the courts to get FPC to reconsider the case. The suit has been postponed pending a probable review of the application.

TWENTY-FIVE multi-colored displays like this are kept on display in Consolidated Edison commercial offices in Westchester County. They measure 51 by 40 in. and include names of the winners of the "Sports Award of the Week." Because a new name is added each week, the display's news value keeps increasing. Two boards are also displayed at Station WFAS from which the program, "The Scholastic Sports Page," was broadcast at 5 and 8:30 PM, Thursdays

Con Edison Honors Athletes

Weekly radio program names outstanding player in 'sports' ranging from baton twirling and marksmanship to football

For 40 weeks, beginning Sept. 13, 1951, Consolidated Edison Co of New York has been honoring the outstanding scholastic athletes in the territory served by its Westchester Division.

The athletes, including five girls, were participants in football, basketball, baton twirling, swimming, hockey, tennis, golf, marksmanship, horsemanship, baseball, and track. Each received a gold and silver medallion and a framed certificate.

WFAS and WFAS-FM, White Plains, carried the company-sponsored program, "The Scholastic Sports Page." This 15-minute broadcast consisted of an interview with the winning athlete, the award presentation, a review of scholastic sports in the county, and frequently a few remarks by the player's coach.

Panel Picked Winners . . . Con Edison placed full responsibility for the program in the hands of the sports editor of the station and a panel of 12 judges. Each week the sports editor and three of the judges selected the winner from a list of nominees.

The winner not only had to excel in his sport but also had to set an example to youth of good sportsmanship. The set up was such that student team managers who ordinarily might be were not overlooked.

Broadcast time was 5 PM, Thursday. Because of the general interest in the program it was rebroadcast from transcription at 8:30. The last award was made June 26. During the summer the program will be continued. One of the coaches who served as a judge will be interviewed, and the remainder of the time will be devoted to amateur sports.

The program grew out of "Your Program." This had been sponsored by the company for 12 years as a half-hour show. It featured home economics, county history, transcribed music, and guest interviews. It was continued as a 15-minute program.

Freedom Production Theater TV Schedule

A 13-week television show, "Production for Freedom Theater," which will dramatize America's industrial production, is being presented by the American Broadcasting Co. Most stations are carrying the program from 6 to 6:30 or from 9:30 to 10 PM, Sunday. But as stations have their choice of time, check local newspapers.

The program is intended to show what America's industrial production has accomplished in providing better living and greater assurance of peace. The films have been contributed by leading industry associations and corporations.

Coming programs include:

July 6—"And a Voice Shall Be Heard." This General Electric Co film shows a mock atomic attack on Syracuse, N. Y. It shows the importance of electronic communications. Dr W. R. G. Baker, General Electric; and Lt Gen Willis D. Crittenberger, commanding the First Army, will discuss civil defense. Westbrook Van Voorhis, the announcer, will be moderator.

July 13—"We Call It Big Creek." This will be the story of the construction of this Southern California Edison Co dam and powerhouse.

An Error Corrected

Through an error the directors of the service activities of the Public Utilities Advertising Association were incorrectly listed in the June 19 issue. These directors are George W. Kindon, Philadelphia Electric Co, chairman, Advertising Exchange Service; Fenton Kelsey, Jr, Electrical Information Publications, Inc, editor, "PUAA Bulletin"; and James V. Macdonald, Boston Edison Co, chairman, 1953 Better Copy Contest.

Penelec Ad Men Move

Pennsylvania Electric Co has moved its Advertising and Publicity Department, headed by G. T. Clifford, from Erie to Johnstown, company headquarters. The address is 222 Levergood Street, Johnstown, Pa.

Interior Wins Idaho Line Case

Court rules department has claim to excess capacity on transmission link traversing public lands

Interior Department has a claim on the excess capacity of electrical transmission lines traversing public lands under its jurisdiction.

This is the ruling of Federal Judge Walter M. Bastian of the U. S. District Court for the District of Columbia in the case of Idaho Power Co vs Oscar L. Chapman, Secretary of Interior (EW, March 17, p 9).

Chapman Upheld . . . Judge Bastian upheld Chapman on the main issue involved in the case. An appeal by Idaho Power is almost certain.

Transmission line involved in this particular case is a 69-kv line from Huntington to Baker, Ore., which cost approximately half a million dollars. In granting a permit to Idaho Power to construct a portion of the line across public lands, Interior sought to require the company to share any excess capacity of the line with the federal government. The permit also sought to allow Interior to increase the capacity of the transmission lines at its own expense and take over this increased capacity for permanent use.

Surrender of Rights-of-Way . . . Most sweeping condition of the permit would require the company to surrender the rights-of-way and transmission lines to the federal, state, or local governments which a regional administrator may designate.

In a brief "memorandum of the court," Judge Bastian found that since these regulations have not been enforced, the company can show no damage. Hence, "it is believed that 'the controversy is not yet ripe for equitable intervention!' "

However, the federal judge went on to say that even though the case is not yet ready for judicial review, it could also be dismissed on other grounds. Among these are:

1. ". . . the right of the Secretary of the Interior to grant an easement of right-of-way includes the power to grant an easement of right-of-way on condition.

2. ". . . the regulations adopted seem to the court to be reasonable and to furnish adequate protection to the plaintiff (Idaho Power)."

Important Implication . . . By implication, the decision also upholds Interior in requiring a company to sign a written stipulation agreeing to such conditions before a right-of-way application will be considered.

A case which would similarly affect electric companies is now before the Supreme Court with argument scheduled for this coming fall. In this case —Idaho Power vs Federal Power Commission—the company is contesting the FPC authority to write similar conditions into a license granted for construction of a transmission line traversing public lands.

AIEE Elects Quarles President for 1952-53

Donald A. Quarles has been elected 1952-53 president of the American Institute of Electrical Engineers. He will take office in August.

The new AIEE head is president of Sandia Corp, Alberquerque, N. M., and vice president of Western Electric Co, New York. He is a former vice president of Bell Telephone Laboratories.

A graduate of Yale University, Quarles spent two years in the Army before joining Western Electric Co in 1919. He has been active in many engineering societies and has served as a member of AIEE's board of directors and on several technical committees.

The association elected the following vice presidents: William S. Hill, General Electric Co; M. D. Hooven, Public Service Electric & Gas Co; W. L. Cassell, professor of electrical engineering, Iowa State College; C. Myron Lytle, Kansas City (Mo.) Power & Light Co; and Thomas Ingledow, British Columbia Electric Co.

Hearing Recessed

Discussion on Hells Canyon project is terminated by House Interior subcommittee

The friction between Congress and the Bureau of Reclamation was heightened last week when the House Interior subcommittee abruptly terminated hearings on the Hells Canyon project. The bureau has been pressing for approval of HR 5743 which would authorize start of work on the $357-million dam and power plant at Hells Canyon as the first link in the Snake River Reclamation project.

As the Engle subcommittee was preparing to hear opposition witnesses from Idaho, Rep Norris Poulson (R-Calif) moved to recess the hearings until further notice. Not even committee Chairman John Murdock (D-Ariz), and author of the bill by request, objected.

"There really wasn't time to finish action on the bill this session," Murdock said "My main purpose in holding hearings was to get a record established. I haven't visited the Hells Canyon site and recessing the hearings will give me a chance to study the testimony."

Members Irritated . . . But Republican members of the committee claim there is a lot more than the time factor involved in halting the hearings. They have been irritated by attitude of the bureau on the legislation and took particular exception to reported remarks made by Commissioner Michael Straus in Idaho to the effect that he didn't expect the legislation to get through this session and that the hearings were merely to "educate the committee."

"We've had enough education," said Rep John Saylor (R-Pa), "so I guess it's time to stop. What the committee doesn't like is the attitude of Straus and the bureau and unless they change it, they may jeopardize a lot of worthwhile legislation."

Ontario Faces Rate Increase

Hydro-Electric Power Commission chairman predicts boost because of more use of steam generation and higher costs

Higher rates were predicted by Hydro-Electric Power Commission of Ontario's Chairman Robert Saunders by the early part of 1953 to both municipalities and rural consumers.

In a radio report recently, he declared: "Hydro studies made to date indicate that some increase in the rates to the municipalities and rural customers will be necessary as of Jan. 1, 1953, if we are to maintain our sound position."

Increase Not Yet Known . . . Although he was unable to give the percentage boost at present, he was hopeful that the commission and the municipalities still would be able to supply electric power to residential consumers at an average rate lower than that prevailing and prior to 1938. However, he promised that there would be no increase during the rest of 1952.

He pointed out that the commission's wage rates have more than doubled since 1939 and construction wages have increased 145.3%. The cost of trimming trees has jumped from $3 a tree in 1948 to $4.22 in 1952. Material costs have also showed increases, he said.

The cost of power will increase, the chairman stated, because the commission is being forced to use more and more steam generation. He cited that steam power will represent about 24% of the cost of power in 1953, whereas it was less than 1% of the total cost in 1951.

Wants St. Lawrence Developed . . . He made a strong plea for the right to develop the St. Lawrence River which, he said, has a power potential of 6.3 billion kwhrs. "Is it any wonder we at Hydro are pleading for the St. Lawrence power development?" the chairman asked. "The power must come, if not from the St. Lawrence, then from steam. The same amount of St. Lawrence power would require about 3,150,000 tons of coal if produced by steam generators. At $8 a ton for coal, that represents a cost of $25.2 million each year for coal alone. St. Lawrence power under the 1951 agreement would cost about 2.8 mills per kwhr. A kwhr of steam power costs 7.25 mills," he said.

Bonneville Power Rates May Be Reduced in 1954

A reduction of Bonneville power rates in 1954 is a distinct possibility, because Bonneville payments to the federal treasury have exceeded the required schedule for paying out construction costs from power revenues by more than $50 million, the Washington Public Utility Commissioners Association has been informed by William Dittmeyer, BPA power manager.

A revised schedule of paying out construction costs from power revenue also is under study, said Earl Ostrander, BPA comptroller. Under the present schedule, construction costs are to be paid within 50 years of the completion of each project, with replacement costs also to be paid during the last 30 years. Since all Pacific Northwest power projects are likely to be producing long after 50 years with only partial replacement of equipment foreseeable, BPA proposes to extend by ten years or more the replacement pay-off periods, thus making possible a lower pay-out rate. Such a proposal must be approved by the Federal Power Commission.

The PUD commissioners passed a resolution asking Congress to name the lake behind Joseph Dam on the Columbia River after Rufus Woods, late Wenatchee publisher who advocated the project.

FINANCIAL BRIEFS

Gallup, N. M., voters have approved a bond issue to finance a $1.7 million expansion program for their municipally owned power system. Earlier town board had turned down Public Service Co of New Mexico's offer to purchase the system.

California-Pacific Utilities Co has placed $2 million 4¼% debentures due 1972 with two insurance companies . . . **Niagara Mohawk Power Corp** has received New York Public Service Commission approval to merge 129 year-old Oswego Canal Co with it.

Halbur, Iowa citizens vote 84-to-0 to renew 25-year franchise with Iowa Public Service Co . . . **Securities and Exchange Commission** has set hearings for July 9 on Electric Bond & Share's plan to change from a public utility holding company into an investment company . . . **Florida Power & Light Co** has sent to the nation's financial analysts a new 215-page booklet on the State of Florida. It contains no advertising but it fits in with the company's policy of trying to help itself by helping Florida grow. For copy, write President McGregor Smith, Florida Power & Light Co, 25 S. E. 2nd Ave., Miami 30, Fla.

Pennsylvania Water & Power Co has begun $19,280,000 damage suits against one of its principal wholesale customers, Consolidated Gas, Electric Light & Power Co of Baltimore. It is charging Consolidated violated the federal anti-trust laws and has neglected to pay up some back bills.

Southern Colorado Power Co has sold $1 million 3¼% first mortgage bonds to institutions . . . **The utilities committee** of the Seattle City Council has approved the request of E. R. Hoffman, City Light superintendent, to sell $25 million City Light revenue bonds. "We want to sell these bonds in the immediate future because the market for municipal revenue bonds is exceptionally good at this time," Hoffman wrote the Council.

Crawford F. Parker announced he would resign as a member of the Indiana Public Service Commission around Sept. 1, to give full time to his campaign for election as Indiana secretary of state.

Hawaiian Electric Co is planning to ask for its first rate increase in more than 30 years . . . **Towns of Albertville and Russellville, Ala.,** will reduce rates to consumers about 9% and 10%, respectively, effective July 1.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
1952									
June 18	**2.94**	**3.00**	**3.09**	**4.03**	**4.28**	**4.38**	**5.35**	**5.86**	**6.41**
June 12	2.95	3.00	3.09	4.00	4.24	4.36	5.34	5.88	6.40
1st 1952	2.95	2.99	3.13	4.11	4.29	4.66	5.35	6.03	6.47
4th 1951	3.02	3.07	3.21	4.32	4.50	4.91	5.42	6.18	6.84
3rd 1951	2.87	2.91	3.04	4.05	4.27	4.61	5.52	6.24	7.05
2nd 1951	3.02	3.11	3.23	4.11	4.37	4.68	5.73	6.38	7.37

Data: Reis & Chandler, Inc.

EARNINGS

	Period Months Ended		Net Income 1952	Net Income 1951	Earnings Per Common Share 1952	Earnings Per Common Share 1951
Carolina Power & Light	12	May	$6,550,583	$6,200,805	$	$
Central Illinois Light	12	May	3,057,709	2,151,407	2.84(a)	2.94(a)
Detroit Edison	12	May	15,624,404	16,099,422	1.63(a)	1.80(a)
Minnesota Power & Light	12	May	3,257,684	3,493,456	3.12	3.40
New York State Electric & Gas	12	May	7,158,680	5,717,282	2.26(a)	2.16(a)
Ohio Edison, consolidated	12	May	14,682,839	14,359,926	2.74(a)	2.70(a)
Pennsylvania Power	12	May	1,974,506	1,640,520		
Southern Indiana Gas & Electric	12	May	1,750,286	1,896,463	1.95	2.17
			1951	**1950**	**1951**	**1950**
New Orleans Public Service	12	Dec.	$3,437,064	$3,453,273	$	$

Notes—The figures for the last company have been audited; (a) Based on shares outstanding at end of period.

FINANCING

Company and Description	Amount of Offering ($000)	Offering Price	Yield to Public
WEEK OF JUNE 19-25			
Bonds			
Central Louisiana Electric—1st mtg 3¼% 1982	$4,000	103.00%	2.59%
Boston Edison—1st mtg 3⅛% 1982	15,000	100.485	3.10
Gulf Power—1st mtg 3¼% 1982	7,000	100.47	3.35
Public Service Co of Indiana—1st mtg 3⅛% 1982	25,000	102.384	3.25
New England Power—1st mtg 3¼% 1982	5,000	100.875	3.20
Preferred Stock			
Public Service Co of New Hampshire—50,000 sh $100 par cum	$5,000(b)	.....	.....
Common Stock			
Northern States Power (Minn.)—1,108,966 sh (being offered to commonholders on 1-for-10 basis (a), record June 5 to expire June 23)	$11,644	$10.50	6.67%
Empire District Electric—150,000 sh	3,300	22.00	6.36%
WEEK OF JUNE 26-JULY 2			
Common Stock			
Pacific Gas & Electric—2,271,300 sh (being offered to stockholders on 1-for-5 basis, record June 10 to expire July 2)	$68,139	$30.00	6.67%
SCHEDULED FOR JULY-AUGUST-SEPTEMBER			**Bid Date**
Bonds			
Georgia Power—1st mtg 1982	$20,000	.....	July 8
Commonwealth Edison—1st mtg 1982	40,000	.....	July 15
Pennsylvania Electric—1st mtg 1982	9,500	.....	Aug. 5
Arkansas Power & Light—1st mtg 1982	15,000	.....	Sept. 9
Debentures			
Houston Lighting & Power—convertible debs 3¼% 1967 (being offered initially to commonholders of record June 17 to expire July 7 on basis of $50 principal amount of debentures for each 16⅔ shares held; debentures are to be converted initially into common at $17.50 per share)	$14,206	$100.00	3.25%
Preferred Stock			
Gulf States Utilities—50,000 sh $100 par	$5,000	.....	July 22
Pennsylvania Electric—45,000 sh $100 par	4,500	.....	Aug. 5
Common Stock			
Missouri Utilities—18,280 sh (being offered commonholders on 1-for-14 basis, record June 16 to expire June 30)	$283	$15.50	6.45%
Public Service Co of New Mexico—173,136 sh (being offered commonholders on 1-for-7 basis, record June 17 to expire July 8)	1,385	8.00	7.00%
Southern Co—1,004,510 sh (being offered to commonholders on 1-for-16 basis, record June 19 to expire July 10)	12,806	12.75	6.27
Florida Power Corp—309,300 sh (to be offered commonholders on 1-for-5 basis, record about July 1 to expire July 16)	.....	.....	.....
General Public Utilities—531,949 sh (to be offered commonholders on 1-for-15 basis, record July 1 to expire July 23; fractional shares will not be issued but holders will be reimbursed in cash; additional stock to carry 35c dividend payable Aug. 15)	.....	.....	.....

Notes—(a) Stockholders are allowed oversubscription privileges; and (b) Company rejected the only competitive bid received which came from Kidder Peabody & Co-Blyth & Co group who offered to pay $100.02 a share for 5.60% dividend rate. Underwriters had planned to reoffer it to the public at $103.50 per share to yield 5.41%.

CALENDAR

Canadian Electrical Association
Annual Convention, Banff Springs Hotel, Banff, Alberta, June 30-July 2.

Maryland Utilities Association
Cavalier Hotel, Virginia Beach, Va., Sept. 5-6.

Rocky Mountain Electrical League
Fall Convention, Colorado Hotel, Glenwood Springs, Colo., Sept. 7-10.

American Standards Association
National Standardization Conference in conjunction with Centennial of Engineering, Museum of Science-Industry, Chicago, Ill., Sept. 8-10.

Illuminating Engineering Society
National Technical Conference, Edgewater Beach Hotel, Chicago, Ill., Sept. 8-12.

American Society of Mechanical Engineers
Fall Meeting, Sheraton Hotel, Chicago, Ill., Sept. 8-11.

Edison Electric Institute
Accident Prevention Committee, Sheraton Hotel, Rochester, N. Y., Sept. 15-16; Prime Movers Committee, Roosevelt Hotel, New Orleans, La., Oct. 6-7; AEIC joint meeting, Meter-Service Committees, Mayflower Hotel, Washington, D. C., Oct. 6-8; Electrical Equipment Committee, Roosevelt Hotel, New York, Oct. 13-14; Transmission-Distribution Committee, Hotel Adolphus, Dallas, Tex., Oct. 23-24.

***Pennsylvania Electric Association**
Annual Meeting, William Penn Hotel, Pittsburgh, Pa., Sept. 16-17.

***Northwest Public Power Association**
Accounting Section, Congress Hotel, Portland, Ore., Sept. 18-19.

Public Information Program
Annual Workshop Conference, Edgewater Beach Hotel, Chicago, Ill., Sept. 18-19.

Public Utilities Association of the Virginias
Greenbrier Hotel, White Sulphur Springs, W. Va., Sept. 19-20.

National Electronics Conference
8th Annual Conference, Sherman Hotel, Chicago, Ill., Sept. 29-30 and Oct. 1.

Wisconsin Utilities Association
Convention of Technical-Sales Sections, Schroeder Hotel, Milwaukee, Wis., Oct. 1-3.

National Farm Electrification Conference
Statler Hotel, Detroit, Mich., Oct. 20-21.

National Electrical Manufacturers Association
Annual Meeting, Haddon Hall Hotel, Atlantic City, N. J., Nov. 10-13.

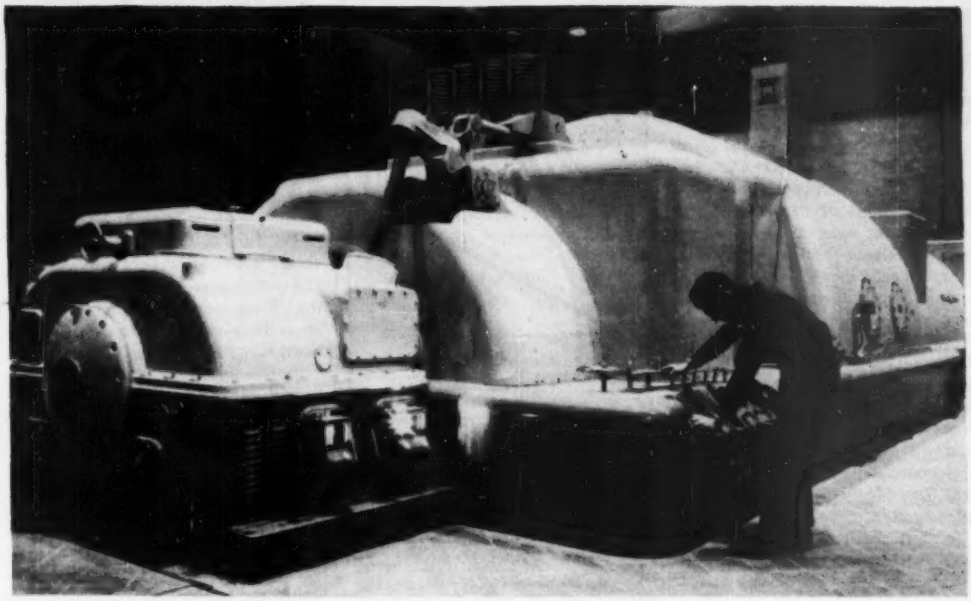
***National Association of Railroad and Utilities Commissioners**
Annual Meeting, Hotel Marion, Little Rock, Ark., Nov. 10-13.

* Addition this week.

REGULATION

By agreeing to change its method of accumulating reserves for depreciation of electric properties, Pacific Gas & Electric Co has cut its rate application request with the California Public Utilities Commission to $33.5 million annually as compared with $37.5 million originally requested.

Iowa Electric Light & Power Co has received approval from 104 cities to increase rates by 8%.



TYPICAL 80,000-KW REHEAT TURBINE-GENERATOR in Dunkirk Station of Niagara-Mohawk Power Corp

General Electric Co

Low Short-Circuit Ratio Is Practical For Today's Turbine Generators

When coupled with modern generator voltage regulators, the reduction in short-circuit ratio from 0.9 to 0.5 opens way to turbine generators having 25% more kva in same frame size, and 10% less generator losses, without sacrifice to stability

S. B. **CRARY**, Manager, Analytical Engineering Dept,

J. B. **McCLURE**, Manager, Power Generation Section, Electric Utility Engineering Dept, General Electric Co, Schenectady

The influence of generator short-circuit ratio* on system operation needs clarification today when larger generators are being widely considered. The need to understand how short-circuit ratio affects system operation has increased recently because of savings which may be realized in larger 3,600-rpm units by using low short-circuit ratios. As larger single units are made possible, further gains in overall station costs will be realized.

Conclusions . . . Several conclusions may be drawn as to reasonable values of short-circuit ratio for large turbine generators connected to modern systems. They are these:

1. Turbine generators with effective short-circuit ratios in the order of 0.5 may be expected to give successful performance on power systems equipped with modern generator voltage regulators.

2. Ability to capitalize now on this simplification in generator design requirements is primarily the result of continual improvements in generator voltage regulator design.

3. Relaxing on S.C.R. as a fixed requirement will give greater freedom in generator design so that the mechanical, thermal, and electrical characteristics may be more advantageously coordinated.

4. Acceptance of low short-circuit ratio gives these advantages:

a. With any given type of cooling, 20 to 25% more kva can be obtained from the same frame size, by reducing S.C.R. from 0.9 to 0.5.

b. Ability to put more kva into a given frame size or, conversely, to use a smaller frame size for a given kva will reduce generator cost and accordingly reflect lower prices.

c. Reducing S.C.R. from 0.9 to 0.5 will reduce the total generator losses by approximately 10%.

d. Higher reactances associated with lower S.C.R. will help to keep down breaker interrupting duties without significant effect on transient ability.

5. A new term called "Effective

* Short-circuit ratio (S.C.R.) is a measure of the electrical stiffness of a generator under steady state or sustained conditions. Its test value is determined from the synchronous impedance and open-circuit saturation curves as shown in Fig 1.

S.C.R." is a convenient means of comparing relative machine characteristics for outputs that vary with hydrogen pressure.

Stability Under Manual Control . . . When the stability problem was first recognized and studied in the early 1920's, it became apparent that generators of high short-circuit ratio were desirable. Most of the turbine generators then were operated under manual control without automatic voltage regulators. It was found that if a system disturbance occurred, the units most susceptible to pulling out of step were those with low short-circuit ratios. Systems were not so large then as they are today and a change in loading resulted in greater frequency and voltage changes than occur in today's systems where the interconnected systems are under some form of automatic load and voltage control.

A short-circuit ratio of unity provides an electrical stiffness such that a generator initially operating at no-load (synchronizing field current) can pick up full kilowatt loading without loss of stability when connected to a system that was relatively large compared to the machine rating. As systems grow in size, no one machine is subjected to such a large change in kilowatt loading unless it is on supplementary control of frequency or tie-line loading. Even then the magnitude and rate of load pickup, even during an emergency, could be limited. However, operating experience indicates accumulative loss of synchronism of units under manual control still occurs even with unity short-circuit ratio generators.

Loss of Field . . . One of the important causes of disturbances leading to load interruptions—and for many systems the most severe—is loss of field on one of the larger units of the system. Such an occurrence may result in general reduction in voltage because of the large reactive power drawn by the generator after it pulls out of synchronism.

Studies indicated that the loss of field on one generator did not result in loss of stability in other generators if they were equipped with voltage regulators and modern excitation systems. This led to a better appreciation of the value of generator voltage regulators and the desirability of disconnecting such units before they

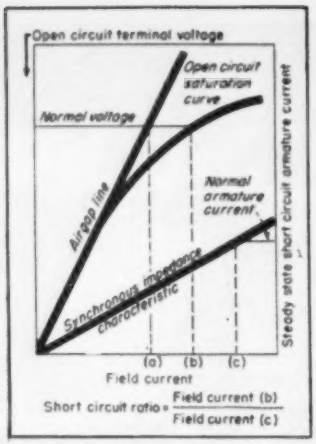

Open circuit terminal voltage
Open circuit saturation curve
Normal voltage
Air gap line
Normal armature current
Synchronous impedance characteristic
Steady state short circuit armature current
(a) (b) (c)
Field current
Short circuit ratio = Field current (b) / Field current (c)

FIG 1—NO-LOAD SATURATION and synchronous impedance curves vs field current for synchronous machine

cause the loss of synchronism of additional units. Moreover, these studies showed that if generator voltage regulators were not in use on the larger and more important generators, loss of synchronism of additional units might occur.

Consequently, loss of field relaying was developed and applied on those systems **where voltage regulators could not be easily applied,** either because of limitations in the design and arrangement of the existing excitation system or because of lack of confidence in automatic means for control of voltage. Such relaying disconnects the generator which has lost its field quickly enough to prevent imposing a prolonged reactive burden on the system.

From a system stability standpoint the quick automatic disconnection of a generator that has lost field is not necessary if remaining generators are provided with modern automatic voltage regulator control and excitation systems.

The advantages of voltage regulators during major changes in system impedance or during major changes in load kilowatt and reactive have been verified by operating experience. Within the last two years it has been shown in several cases that severe disturbances with interruption of large blocks of load could have been prevented if the generators had been equipped with automatic voltage regulators.

Whereas a short-circuit ratio of unity may have been required in the past for operation under manual control (and even then, operation would not necessarily be satisfactory), the general use of automatic voltage regulators today requires a re-evaluation of the need for high short-circuit ratio.

Indirect Acting Rheostatic Generator Voltage Regulators . . . Steady-state stability limits of generators are shown in Fig 2 and 3. They are for different short-circuit ratios as a function of external reactance when operating at 0.8 pf over excited and unity power factor for various amounts of external reactance. These results apply to the indirect acting rheostatic type of regulator that has been used for over 20 years on turbine generators. This regulator is the deadband or notching type which provides what might be considered very close manual control for normal system voltage changes. Under emergency conditions, however, (−5%) full exciter rate of rise can be realized by quick operation of contactors in the exciter field. This type of regulator and excitation system is much more effective than using generators of high short-circuit ratio.

Also as shown by Fig 2 and 3, stable system operation was obtained with low short-circuit ratio even for unity pf operation for the normal range of external reactances and even up to an unusually large external reactance of 0.8.

Fortunately it is not necessary to have all of the generator voltage regulators in operation in a large system at the time of an emergency. It is the general or overall effect of being able to maintain the voltage of the system which is beneficial. As the modern voltage regulator has become a very reliable piece of equipment, most of the regulators will be in service.

Of course, there are many recognized advantages from the use of automatic generator voltage regulators. They regulate transmission bus voltage, they automatically correct the amount of required reactive associated with major line trip-outs, they are indispensable for machines assigned to supplementary automatic control of tie-line loads and frequency, and they reduce the total investment required for kvar used in the load areas for voltage control.

Modern Voltage Regulators . . . Further development of continuously-

acting non-dead-band voltage regulators increased materially the margin of stability in the underexcited region. This development fortunately coincides with the increased requirement of systems to operate further in the underexcited region as the result of the continued application of unswitched shunt capacitors and the connection to the system of large amounts of line charging from overhead lines or cable.

Curve A in Fig 4 shows the steady-state limit of a 0.9 effective S.C.R. generator connected to a system with $X_e = 0.4$, either on hand control or with a type of voltage regulator with dead band. These limits are well beyond any practical requirement on a system. Curve B, Fig 4, shows the steady-state limit of the same generator under the control of a modern voltage regulator, of the continuously acting, no dead-band type. Note the widely increased margin in underexcited rkva.

Curve A in Fig 5 shows the steady-state limit of a generator with effective short circuit ratio 0.45—just one-half the short-circuit ratio of Fig 1—connected to the same system and with the older type regulator. Admittedly, the steady-state margin has decreased. Curve B, Fig 5, shows that the steady-state limit of a 0.45 short circuit ratio machine and the modern voltage regulator practically coincides with the former limit of 0.9 short-circuit ratio machine and the older type regulator with dead band.

In deriving the curves in Fig 4 and 5, the effect of saturation has been only partially included by the assumption of synchronous impedance being equal to the reciprocal of S.C.R. Thus the results shown are pessimistic and when the effect of saturation is completely included still further margins will be realized.

This additional margin, realized through the use of a modern regulator, eliminates for all practical purposes the need for short-circuit ratio higher than about 0.5. Completely successful performance can be obtained with the continuously acting voltage regulator in the underexcited region for most all system conditions encountered by turbine generators. This performance makes it possible to reduce the size of the alternator and thereby obtain an important saving.

For the remote possibillty of loss of operation of a voltage regulator in a single generator, proper setting of the exciter field rheostat will result in a slight increase in excitation on that machine. This merely places a greater responsibility on other machines under regulator control to maintain bus voltage but will not result in any instability.

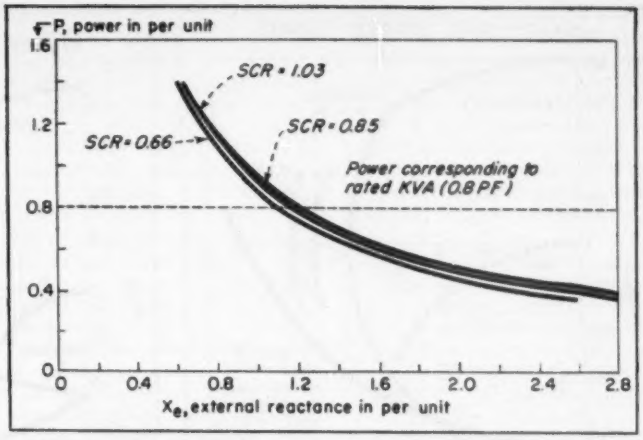
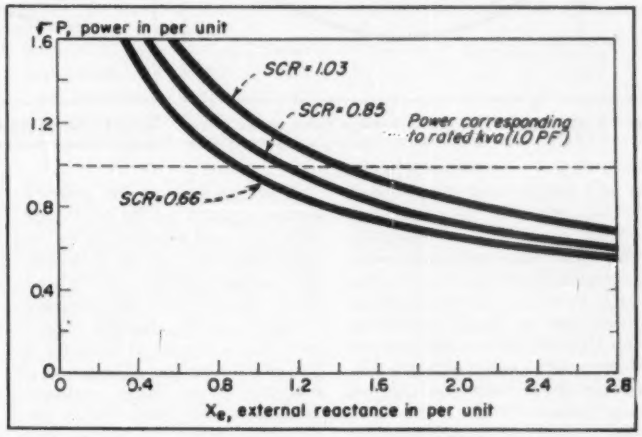


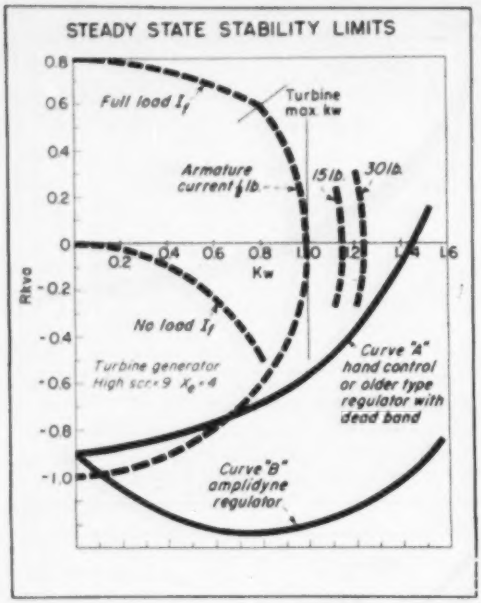
FIG 2-3—STEADY-STATE POWER LIMITS of turbine generators with various short-circuit ratios operating at normal terminal voltage and at 0.8 pf (above) and 1.0 pf (below)



Tests and Experience . . . This ability of continuous acting "no dead-band" regulators to increase the steady-state margin has been known for years because of analysis and laboratory tests. In 1946 the first field tests were made on a hydrogenerator operating beyond the steady-state limit obtained with the "dead band" type regulator. In 1951 similar tests were made both at Chenault Falls hydro station and at Moss Landing steam station. These several tests demonstrated the outstanding advantages of modern regulators.

These analyses and tests have showed that the continuously acting voltage regulator is capable of operating well beyond the point where the rheostatic type of regulator can operate. They have showed very steady operation in this region, beyond where the rheostatic regulator is capable of operating, thus giving operators confidence that they can use considerably lower short-circuit ratio generators than they have required in the past.

Automatic Lower Excitation Limit . . . The continuously acting voltage regulator has another feature which makes it highly reliable when operating in the underexcited region. This is the



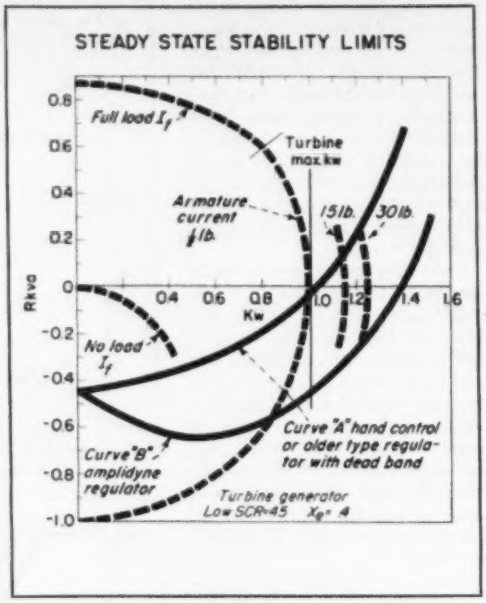


FIG 4-5—CAPABILITY CURVES for hydrogen-cooled turbine generator of 0.9 S.C.R. (left) and 0.45 S.C.R. (right) as well as steady-state stability limits in underexcited region with both manual control and modern voltage regulator control of excitation

use of a reactive kvar lower limit of excitation that lets the operator fix the limit of underexcited operation. This limit not only prevents misoperation, such as incorrect settings for the voltage to be held by the regulator, but also gives the operator confidence in his ability to operate the generator further in the underexcited region than has been his previous experience on power systems.

The voltage regulator's lower limit should not necessarily be used to protect against operation beyond the thermal limit. This can be taken care of most effectively in the normal method of loading the generator. The limit of operation of the generator voltage regulator, on the other hand, should be based primarily on the stability limit so that full use of the voltage regulator's capability may be available to the system in an emergency. In some cases the generator reactive lower limit has been set according to the sustained thermal requirements at a sacrifice of the voltage regulator's ability to maintain desired voltage during an emergency. A reactive limit has been developed which is a function of the kilowatt loading, thus allowing considerable flexibility to meet the requirements of any particular location on the system.

TABLE I—Actual and Effective Short-Circuit Ratio Compared for Various Generator Ratings

Generator	Generator Rating, Kva	Short Circuit Ratio	
		Actual	Effective
Prewar Air Cooled	Maximum Turbine kw	0.9	0.9
H₂ Cooled—Regular	1 ½ psi kva = Max Turbine kw	0.9	0.9
H₂ Cooled—Preferred Standard	1 ½ psi kva = 1.07 Times Max Turbine kw	0.8	0.86
	15 psi kva = 1.23 Times Max Turbine kw	0.695	0.86
	30 psi kva = 1.34 Times Max Turbine kw	0.64	0.86
Generator of Fig. 4	1 ½ psi kva = Max Turbine kw	0.9	0.90
Generator of Fig. 5	1 ½ psi = Max Turbine kw	0.45	0.45
Generator of Fig. 5	30 psi = 1.25 Times Max Turbine kw	0.36	0.45

Effective Short-Circuit Ratio . . . The operation of hydrogen-cooled generators at higher hydrogen pressures has resulted in assigning not only a nameplate rating at some hydrogen pressure, but also generator capabilities at higher hydrogen pressures. When the short-circuit ratio of a generator is expressed on a kva base corresponding to the higher capabilities, a still lower number is obtained. This up-rating of a generator at higher hydrogen pressures, with a corresponding decrease in S.C.R., has caused both concern and confusion in some instances. The important factor is the ability of a generator to deliver the maximum output from the turbine to the system. Thus in order to avoid this confusion and concern a term "Effective Short Circuit Ratio" has been introduced where:

Effective S.C.R. = Actual S.C.R. on generator kva base x gen kva base/max. turbine kw.

The usefulness of this term is illustrated in Table I which shows it to be independent of hydrogen pressures. Whereas the Effective S.C.R. of many air-cooled machines was 0.9, the Effective S.C.R. of the preferred-standard generator is 0.86. It should be noted that while an effective S.C.R. of 0.5 will give successful performance on practically any system, this may well

Table II—Surge Impedance Loading And Line-Charging Requirements of Transmission Lines

Line Voltage Kv	Surge Impedance Loading—Kw	Charging Kva Per 100 Miles
34.5	3,000	600
69	12,000	2,500
138	48,000	10,000
161	65,000	13,000
230	139,000	27,000
287	205,000	42,000
345	300,000	62,000

result in actual S.C.R. of values considerably lower than 0.50 for generators with a capability at high hydrogen pressures (See Table I).

Generator Ratings . . . With individual systems growing rapidly and with increased high voltage inter-connections, there is a sound economic basis for the continued (economical) demand for larger single blocks of generation. This demand is being met now with two solutions, viz, the tandem-compound multiple exhaust turbine generator set and the cross compound set.

The single high-speed generator for the tandem arrangement encounters an upper rating limit because of mechanical considerations. Rotor diameter and length are both severely limited. The diameter is limited by centrifugal stresses which are extremely high in 3,600-rpm machines. The length is limited by vibrational considerations, particularly the critical speed which has a pronounced bearing on mechanical operation. The amount of conductor material employed in the field winding is also limited severely by the centrifugal stresses. The largest practical rotor will therefore have a definite maximum ampere-turn capacity for any specific type of ventilation which may be employed.

Reduced short-circuit ratio permits much more load to be carried for the same maximum ampere-turn capacity of the field winding. This assumes that the armature can be designed for the increased output which is generally true, particularly if the designer is given a free choice of armature voltage rating.

Likewise, in machines of less than limiting dimensions, reduced short-circuit ratio will permit more power to be generated. This means that, in general, dimensions will be smaller, resulting in reduced weight, less excitation power, and some improvement in efficiency. The reduction in dimensions and weight also reduces the cost of the generator appreciably.

The present trend toward direct ventilation of field winding is greatly increasing their ampere-turn capacity. This obviously makes possible the design of large generators with high short-circuit ratios. But with corresponding improvements in stator cooling also in progress, the advantages of reduced S.C.R. can well be utilized—either to produce still larger ratings within the limiting dimensions or to make more economical and efficient designs for the ratings desired.

All these gains are likely to be difficult to realize without general acceptance of reduced short-circuit ratio, which would permit standard designs to be developed with proportions that take the best advantage of the potentialities. In these days of rising costs, it seems more important than ever that such an opportunity for economy and general improvement be recognized and acted upon, especially when it can be demonstrated that no handicap in performance is involved.

Reducing the short-circuit ratio inherently reduces excitation power requirements. This, in itself, reduces generator losses, and so improves efficiency. However, a considerable reduction in S.C.R. permits a substantially smaller generator design for the same output, and this brings about a still greater gain in efficiency through reduction in core loss, windage, etc. While the kilowatt savings thereby realized are small relative to the machine rating, because of high efficiency of large turbine-driven generators they are appreciable and should properly be credited as additional system generating capacity.

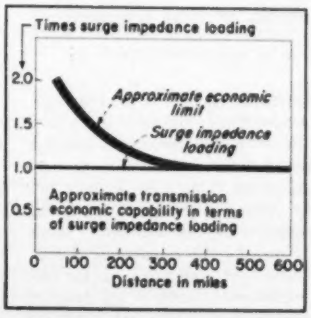


FIG. 6—LINE CAPABILITY. Approximate economic transmission line capability in per unit surge impedance loading

Line Charging Ability . . . It is recognized that a low short-circuit-ratio generator does not have as much line charging ability as the high short-circuit machine—but except in very unusual transmission systems, this limitation will not be significant. Table II shows the line-charging requirements per 100 miles and the surge impedance loading for several transmission voltages.

Fig 5 also shows the typical loadings expected on a modern transmission line. For example, a 200-mile, double-circuit, 230-kv line could be loaded to approximately 300,000 kw with a generator ½ psi rating of the order of 300,000 kva. The charging requirement of such a double circuit line is about 110,000 kva and the charging ability of a 0.45 S.C.R. generator (Fig 5) is about 120,000 kva. It is evident that with these modern concepts of line loading, the generators with S.C.R. as low as 0.5 will normally have adequate charging current ability for straight-away transmission up to 200 miles.

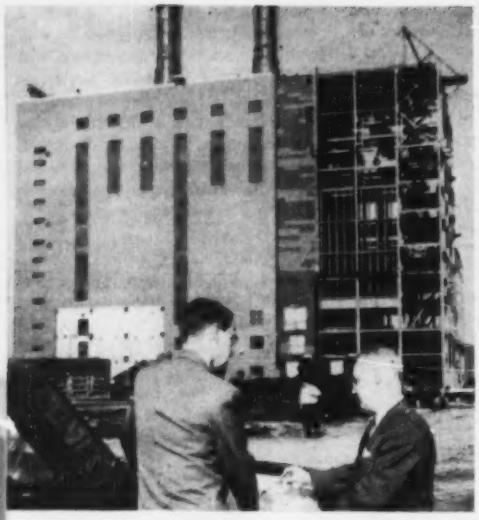
Transient Stability . . . It is recognized that as S.C.R. goes down all generator reactances increase. For values of S.C.R. as low as 0.5 the transient reactances of turbine generators may approach 20 to 30% which is approximately the range of values usually encountered with low speed hydraulic turbine-driven generators. The latter type generators are mostly associated with long distance transmission where stability problems are more acute and where the transient problems are successfully met with modern switching and adequate line sectionalizing.

Summary . . . The purpose of this presentation is to impress on the electric power industry that:

1. The development of the modern generator voltage regulator permits the successful application of turbine generators with appreciably lower S.C.R.

2. Substantial economies in power plant investment may be realized through the industry acceptance of lower S.C.R.

3. Cooperative tests of actual generators equipped with modern voltage regulators and connected to a power system is probably the best method of acquiring confidence in the performance possibilities of these modern regulators.



ALBANY STEAM STATION is to go on the line in August. For this modern 400,000-kw plant, Niagara Mohawk has developed a training program for operators, described in this article

AT THE PLANT SITE key personnel begin training in construction office. Here they become familiar with station blueprints

In every phase of instruction, emphasis is

ON THE JOB at a prototype station is the next step in training for key personnel. Here turbine at Dunkirk station is being started up by station superintendent after major overhaul

Here's How Niagara Mohawk Trains New Station Operators

Training program explains basic routines of operation and maintenance through informal classroom discussions and on-the-job observation. Equipment manual and folder for each job introduce new operators to complexities of high-temperature, high-pressure operation

FRANKLIN S. HELFTER, General Supt of Steam Stations, Buffalo

JAMES R. LARGAY, Supt of Albany Steam Station, Albany

EDMUND R. PAIGE, Supt of Technical Training, Buffalo

All of Niagara Mohawk Power Corp

A training program for supervisors and operators who will run Niagara Mohawk's new Albany Steam Station has the objective of operation for maximum availability and at lowest cost per kwhr. Program is designed in two parts:

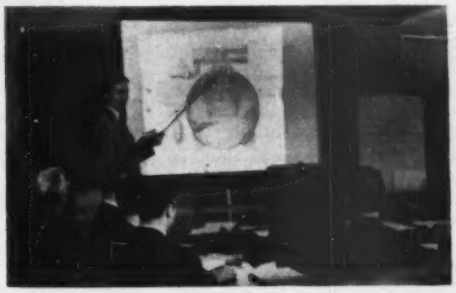
1. Supervisors and department heads receive instructions in informal classroom discussion and through on-the-job observation.

2. Supervisors draw upon these instructions to teach operational and maintenance routines to the operators.

Albany Steam Station is being used as an on-the-job classroom although it is still under construction. It is located on the Hudson River about two miles south of Albany, N. Y., in the company's Eastern Division. Initial plans call for the installation of four 100-Mw units and provisions for further additions. Turbines are designed to use steam at 1,450 psig, 1,000 F/1,000 F reheat. Commercial operation of the first unit is scheduled for Aug. 1. Fewer than 100 men will be required to operate the first two turbine generator units.

Benefits of Training . . . In general, the training program covers operation and maintenance. Training in operation is designed to produce an overall heat rate equal to that designed into the station. Training for maintenance is aimed to give a knowledge of assembly of apparatus so that overhauls and emergency repairs can be handled

IN THE PLANT key men are introduced to major and auxiliary units by station superintendent while station still is building



IN THE OFFICE design engineers explain operation of equipment to key men. These discussions help to insure efficient operation

placed on operation of the new station at lowest cost and for maximum availability

AT THE FACTORY where turbines were made, key personnel learn how governing mechanism works. Lectures on maintenance and operation are presented to personnel by 15 manufacturers

IN THE FIELD key men gives lesson in operation to future operators. Question-discussion periods are first phase of operator training. Each operator gets a folder describing his duties

efficiently to minimize outage time. In addition, safe working practices are being taught to avoid injury during operational and maintenance procedures.

The program is set up so that department heads and supervisors are the first to be trained. They, in turn, train the operators under them. This procedure provides training for all personnel who will operate the station. Training for any individual varies with his position.

Arrival at the new plant of the supervisors and operators was staggered to facilitate training and job changeover (see table). The plant superintendent in charge was at the site from the time construction of the station first began.

Key Personnel . . . A major portion of the program has been given over to training certain key personnel. This group consists of the operating department superintendent, five shift operating supervisors, results department superintendent, maintenance department superintendent, and assistant to the plant superintendent. Their first assignment was to study the blueprints and inspect the plant during construction. This training was under the informal guidance of superintendent of the station and superintendent of operations.

Next, key personnel participated with the design engineers in about ten discussion-lectures, each a half day long. This cooperation between engineers and operators was necessary to insure operation of the plant at design efficiency. For example, points of operation like the following were brought out at the meetings. It was explained that certain shutoff valves should be wide open during normal operation so that automatic pump-speed control will regulate the supply of feed water. Thus, no auxiliary power will be wasted in driving the pumps. In general, operating personnel are being trained to put all automatic devices into service as soon as possible after the plant starts operating.

On-the-Job Training . . . Albany Plant will be a near duplicate of the Dunkirk Plant. For this reason, key personnel were sent to Dunkirk several times for on-the-job training. These visits proved very instructive, especially during a major overhauling of a Dunkirk unit. Some of the supervisors were there prior to its removal from service and during the overhaul. Others saw some of the overhaul and the restoration of the unit to service.

The plan is to have the shift control operators for the Albany Station spend some time at Dunkirk. As various groups move to the Albany plant, training on-the-job is under the direction of the corresponding supervisors

or heads who are responsible for adequate instruction.

Manufacturers Help . . . Lectures on the maintenance and operation of equipment have been presented by manufacturers' representatives to between 30 and 50 of the personnel for Albany Station. In all, about 15 manufacturers have prepared lectures. The manufacturer of the turbogenerators was especially helpful in arranging several trips for key personnel to the factory for lectures and inspections.

Lectures by Niagara-Mohawk Engineers and by the manufacturers' representatives have been aimed at presenting definite operating instructions before start-up of the first unit. In all parts of the training program, operation at least is implied. For example, one lesson contains a chart that shows the number of coal pulverizers to be in service for various loads. This chart is indispensable, but it needs a few qualifying statements regarding whether the boiler is "coming-up" or "coming-down" in load. These statements were discussed until their significance was thoroughly understood by all of the operators.

Training the Operators . . . Because there are no modern pulverized fuel plants in the Eastern Division, operators are being drawn from old stoker-fired plants, hydro stations, substations, shops, etc. To run a modern reheat plant like the Albany Station, operators must be trained in the basic operations.

To aid in their training, a manual is being written by the assistant to the plant superintendent. It will have 25 chapters describing equipment in the station. Preparation of the manual is being handled by the plant superintendent in cooperation with the general superintendent of steam stations, the engineering department, and the superintendent of technical training. These lessons are being used as they are written in teaching new plant personnel, including the shift control operators, auxiliary operators, technicians, and mechanics.

This teaching is being conducted under an unusual and efficient program. Each man in the key personnel group is an instructor. Those being taught, for the time being, are remaining at their former jobs, which are scattered within a radius of 50 miles of Albany. Each key man is scheduled to teach two or three operators at a time an average of one lesson per week.

Schedule of Arrival of Operators At Albany Station

Groups	Months Prior to Commercial Operation of Unit No. 1
Operating Dept Supt* Shift Operating Supervisors* (5) Results Dept Supt* Maintenance Dept Supt* Asst to the Plant Supt*	11
Shift Control Oper (11) Aux D Oper (9) Technicians D (2) Maintenance Foremen (2)	3
Aux B Oper (5) Aux A Oper (4) Coal Handling Foreman Mechanics (6)	2
Utility men Coal Handlers Janitors Gate Keepers and Watchmen	1

* Key personnel

This feature of only about two men per instructor has all the virtues of a private tutoring system. The operators study each lesson prior to the instructor's arrival. A question-discussion form of teaching is used during the lesson. The schedule is arranged to rotate the instructors. To check these methods, three written examinations will be given.

Before start-up of the first unit, each operator will get a folder describing his specific job. Instructions in the folder will be formulated by the plant supervisors under the direction of the plant superintendent. There are three important advantages to this method of issuing instructions:

1. It forces supervisors to be completely familiar with the correct instructions because they have to pass them on to the operators.

2. It employs the principle of formulating and organizing thoughts by writing them down.

3. It makes certain there is a understanding among all concerned.

The written folder is brief and contains only the indispensable, salient points of operation. These can be expanded and put into final form at some later date.

As a last precaution to assure maximum availability and lowest cost of operation, the safety department will survey the plant and list the hazards. It will suggest safe working practices to offset any hazards. Also, our company-wide "mark-up" or "hold-off" system will be covered.

The purpose of this system is to prevent equipment from being inadvertently energized after it has been removed from service for maintenance or inspection work. Warning tags reading "Do Not Operate" are placed on switches, valves, etc, that control the flow of any form of energy into equipment out of service.

In addition, there are forms which are in the controllers office to inform all concerned that the equipment must not be energized. Taken all together, this system guarantees that workmen will not be injured by energized or moving equipment.

Comments on the Program . . . This training program is an extensive one and much time is being devoted to it. In fairness to everyone, new operators and mechanics should have training in advance of the operation of a high-pressure, high-temperature, modern steam-electric station.

Manufacturers have been pleased with the interest indicated by numerous questions asked by operators and mechanics at the lectures. Supervisors who have been taking instructions to the men report very favorable results from the program.

The unanimous opinion was summed up by the plant superintendent who said that if he had to do it again he would make no change.

Disabled Vets Available for 'On the Job Training'

The Rehabilitation Division of the Veterans Administration announces that it has listings from time to time of qualified disabled veteran trainees who are seeking "on the job training" opportunities in the general electrical field.

The young men are screened through vocational counseling to determine their interests, skills, and aptitude for employment in the electrical and related fields. In addition, specialized VA medical men determine the physical capacities of the veteran to perform job operations.

When a potential employer-trainer indicates interest in hiring a disabled veteran, a qualified training officer contacts him at his establishment to work out a training program and wage scale. The VA supplements the veteran's wages.

Firms which have training opportunities for qualified disabled veterans are urged to contact the VA Regional Office in their area.

Let's Take a New Look at Accelerated Amortization Accounting

"Method 4 (and no other method) will reflect the actual historical record of operations . . . It is also the only method which will carry out the intent and purpose of Congress by giving to the utilities the maximum benefit of the law in financing expansion"

W. F. STANLEY*
Dallas, Texas

By now everyone versed in financial, corporate, accounting, or tax matters, in short all those connected in any way with corporate administration, should know pretty well what accelerated amortization is, what it means, its purpose, and the effect of its operation.

Economic Benefit . . . The certificates of necessity granted by the Defense Production Administration to corporations permit them to defer payment of taxes (without interest). Holders of certificates may write off for federal income (and excess profits) tax purposes the cost of new facilities certified as necessary for the defense effort over five years instead of the normal but longer period. This is an economic benefit. But the corporations are benefitting in exactly the manner Congress intended when it enacted the statute.

Accelerated amortization does not grant special tax "savings" but helps American business finance expansion for the defense effort by a five-year deferral of income tax payments. Since the amounts deferred will have to be paid in subsequent years, the government will eventually receive the same amount of taxes, provided tax rates remain the same.

Greatest Need to Electric Industry . . . The electric utility industry, because of its rapid expansion, is one of those which have the greatest need of the financial assistance provided by the accelerated amortization law. Therefore, it is one of those industries for the benefit of which the act was adopted.

To date, four alternative methods of accounting for accelerated amortization have been suggested. None of them offers anything new as the same four were considered at the time accelerated amortization was permitted during World War II. Since these methods have already been mentioned and discussed in other articles on the subject, it seems necessary to mention them only briefly as shown in the accompanying box.

SEC, FPC, and ICC Agree . . . Those who advocate Method 4 appear to have the support of two of the most important federal regulatory bodies, the Securities and Exchange Commission and the Interstate Commerce Commission. It is understood also that the Federal Power Commission holds similar views.

SEC has not formally stated its position since the present statute was enacted. But in its Accounting Release No. 53 dealing with Virginia Electric & Power Co and related to the substantially similar accounting question arising under the World War II accelerated amortization statute, it took this position. It clearly favored the purely historical method of accounting, without arbitrary or artificial adjustments to the income account through depreciation, or charges in lieu of taxes or otherwise. The release states that "no adjustment should be made **within the income statement** based on the estimated reduction of income taxes due to amortization of emergency facilities."

In a recent discussion before the New York Society of Security Analysts a member of the SEC staff, in an unpublished talk, reiterated, clarified, and strengthened the views in Release 53. The speaker clearly stated, however, that he was not speaking for the SEC but expressing his personal views.

The Interstate Commerce Commission requires railroads under its jurisdiction to maintain their former depreciation rates, thus increasing net income by the reduction in income taxes. The Uniform System of Accounts of the Federal Power Commission, to which companies under its jurisdiction are subject, would appear to require a continuance of normal depreciation policy without any increase in depreciation because of the tax reduction. Nor does the system appear to permit the arbitrary deduction from income of a charge in lieu of taxes.

SEC Favors Historical Method . . . It appears that the SEC has consistently supported the historical method of accounting that means that the books of account and published accounting statements based thereon should reflect the actual results of operations and not estimated or pro forma adjustments reflecting operations as they might have been or might be in the future but not as they actually were. Here then are two plans:

1. To keep the books themselves and the statements based thereon so that they reflect a record of the actual history of operations.

2. To take the book figures and introduce estimates and pro forma items to adjust the historical accounts. This is the field of the skilled financial analyst who can make what he feels to be the most realistic projection of future earnings.

For this purpose the actual record of earnings can be adjusted by "averaging" or "equalizing" earnings, or otherwise smoothing out the jagged edges of the year. While this is both the province and duty of the financial analyst, it is dangerous if applied to accounting procedure in recording operating results. For if the actual results are to be adjusted for any items which might be considered of a special or non-recurring nature, where will

* On leave of absence from Southwestern Public Service Co.

this adjusting end? It would be every man for himself and financial statements would lose both consistency and values as historical records of operations.

Except in extraordinary cases (the exceptions which prove the rule) few will contend for Method 1 for electric utilities. The choice lies between 2 or 3 (variants of the same general treatment) on the one hand, and 4 on the other.

The whole matter of accelerated amortization accounting in our present defense effort is still so relatively new that apparently only two state commissions (Michigan and Ohio) have passed on the accounting. The Michigan case was that of Detroit Edison Co. Apparently Method 3 was requested by the company and not required by the public service commission.

There is one aspect of the accounting problem which seems to have escaped attention in all the tumult and the shouting. An aspect that seems of primary importance, namely, the effect the accounting treatment will have on the fundamental purpose which Congress desired to accomplish in enacting the law.

Accounting Methods for Accelerated Amortization

1. Charge income and credit depreciation on the books with the same amount as claimed for rapid amortization of the new facilities in the income tax return. This method reduces net income and surplus by the difference between the amount so charged to depreciation on the books and the reduction in taxes resulting from the five-year amortization.

2. Charge income and credit depreciation on the books with an amount equal to the reduction in taxes resulting from the five-year amortization. Under this method there is no change in net income or surplus by virtue of the accelerated amortization.

3. Charge income and credit a reserve account (usually entitled "Charges in lieu of Federal Income Taxes" or something similar). This is really a variant of No. 2, as the effect on net income and surplus is the same, namely, no change therein. Under this method the charge to income for book depreciation continues as usual.

4. Charge income for depreciation on the books as usual (without adjustment because of the five-year write off). Under this method the reduction in taxes will be reflected by a like increase in next income and surplus.

In each case the reduction in taxes will be reflected in the amount of accrued taxes.

Defer Tax Payments . . . To assist in financing expansion for the defense effort, the purpose was to defer tax payments so that the money could be applied toward expansion or to repay loans obtained to finance expansion. Now in the case of a rapidly expanding electric utility (and only those which are rapidly expanding are likely to obtain certificates) retained earnings plus the deferred tax payments will not be nearly sufficient to provide the needed funds. New securities must be sold to the public. These new securities normally would take the form of bonds, preferred and common stock (perhaps in some cases including debentures). The proportion of each class of security to be sold will be determined by the management.

But these proportions are considerably affected by the policy of the company as to the percentage of common stock equity which it desires to have. As the common stock equity money will cost substantially more than funds raised through sale of senior securities, normally the amount of common stock equity to be sold will be limited to the minimum which will maintain whatever minimum common stock equity ratio is the desired point. To the extent that earnings increase, the common stock equity portion of the new financing can be reduced and the money raised instead through sale of senior securities, at the same time maintaining the desired common stock equity ratio.

Method 4 to Increase Income and Surplus . . . Accounting treatment of accelerated amortization under Method 4 will increase income and earned surplus. This will tend to reduce the amount of common stock to be sold. It thereby enables the company to substitute, for the amount of such reduction, bonds, preferred stock or some other form of senior securities. Such substitution will tend to increase per share earnings on the common stock to the extent of the saving in cost of money from the sale of senior securities as against common stock. This will still further increase surplus and tend to reduce further the amount of common stock to be sold.

So it would seem that in determining the proper accounting treatment, there should first be considered the fundamental purpose of the statute. What treatment will give maximum aid in financing expansion? It must have been the purpose of Congress to reduce, as far as possible, the amount of **common stock equity funds** which would have to be raised by industry in general, and the electric utility industry in particular, since this is the most difficult form of money to obtain and such reduction would thus give maximum aid. Sale of a minimum amount of common stock can be accomplished only by Method 4. Accordingly, to adopt any other method would tend to nullify the very purpose for which the law was enacted.

No Difficulty to Raise Common Stock Equity . . . It is true that to date the industry has found no difficulty in raising common stock equity funds as needed for expansion, at a reasonable cost. There now appears to be no reason to believe this condition will not continue. But the expansion program is far from finished. Another three years may be necessary to see its completion. During this period continued equity financing on a substantial scale will be necessary.

The amount of common stock equity representing reduced income

taxes from the deferral of taxes under the rapid amortization program will, of course, vary substantially with each utility, just as the equity ratio desired varies with each company. In some cases the accounting treatment under Method 4 would reduce only moderately the amount of common stock equity which must be sold to the public to maintain the desired ratio. In others it might make the sale of any common stock unnecessary in a given year or other period.

In any event, such accounting treatment would tend to reduce the amount of common to be sold and thereby reduce financial risk. Thus a company can obtain the maximum benefit from the statute, the maximum benefit Congress intended the industry to have when it enacted the law in financing the expansion program.

As accelerated amortization cannot be deducted until the project is completed, there will normally be a considerable lag between the expenditure for the new facilities and the increase in cash resulting from the tax deferment; but this should not affect the accounting treatment.

Uncertainties . . . There seems to be uncertainty in the minds of some people regarding the attitude of the state public service commissions as to the effect of accelerated amortization on rates and rate making. Here also, the answer seems clear.

Since Methods 2 and 3 would not result in any change in net operating income and accordingly could not affect income for rate making or any other purposes, let us assume that Method 1 were applied in some extraordinary case where it might be justified. Does anyone seriously believe that any state utility commission would be so naive, so unsophisticated financially, as to approve an increase in electric rates to compensate for the loss in income resulting from this accounting treatment. Nor, on the other hand, is it reasonable to suppose that a commission would move to reduce rates (or refuse a justifiable increase in rates) to the extent of an increase in net income resulting from applying accounting Method 4 as shown in the listing on the preceding page.

State commissions, like financial analysts, do not deal solely in historical statements but must consider future expectations. Therefore, they customarily work in the realm of estimates and pro forma adjustments necessary to project into the future the most realistic anticipation of earnings.

Another Good Reason . . . But there is another and better reason why an increase in net operating income resulting from the accounting treatment under Method 4 should not affect electric rates. This relates back to the fundamental purpose and intent of Congress in enacting the law, the purpose of assisting in financial expansion. For if it were to be assumed that a state commission reduced rates because of such increased income (or denied an otherwise justified rate increase to the same extent) the effect would be to reduce the cash income of the company in an amount which would offset the cash benefit of the reduction in taxes. This would defeat the purpose for which the law was enacted.

It seems unthinkable that any state commission would thus nullify the Congressional intent which is part of the overall pattern of our defense effort. So there is no valid reason to fear action by local regulatory authorities.

The increase in income resulting from the reduction in taxes under A A will continue for a number of years. Therefore, it differs from nonrecurring profits or losses limited to a single year, such as upon the sale of capital assets. There has been a tendency to think of this increased income as representing a static amount for each year in a five-year period, thus creating a sort of five-year plateau of increased earnings. Actually it seems much more likely that most of the rapidly expanding electric utilities will receive certificates of necessity for new facilities which will be completed in different years at varying costs. The completion dates may run several years into the future. Thus a company may have pending applications for facilities to be completed in 1954 and 1955.

Assuming continuance of the present emergency, applications may be made and certificates obtained for facilities to be completed in even later periods. This will operate to spread the increase in income over a longer period than five years, which period may be as long as eight, nine, or ten years. So the annual tax reduction (assuming the same rates) will tend to increase until a peak is reached, after which (assuming no further certificates are granted) the annual amount will gradually decrease until all the certified projects have been fully amortized.

The extended period over which the increased income recurs creates an added justification for adhering to historical accounting procedure (Method 4) with proper footnotes giving the pertinent facts about the special tax reduction where the amount thereof in any year is significant.

Summary . . . To summarize, the road of accounting procedure to reflect accelerated amortization on the books and in the published statements of electric utilities appears to be clear and open. Method 4 (and no other method) will reflect the actual historical record of operations. This method appears to have the approval of three of the principal federal regulatory commissions. And, in addition, and most important, it is also the only method which will carry out the intent and purpose of Congress by giving to the utilities the maximum benefit of the law in financing expansion. Finally, for the reasons shown above, applications of this method should have no effect on rates or rate making.

The procedure under Method 4 is simple. It shows what has actually happened, with footnotes describing the special tax reduction and the reasons therefor, where the amount is large enough to be material. It gives the public the facts and gives financial analysts and regulatory bodies the tools to adjust the actual operating results as they may see fit to project future estimates of earnings. But most important—and so important as to warrant a final repetition—it is the only procedure which will give utilities the full benefit that the law intended in helping them finance the large expansion program that is underway.

Footnote—

Since this was written there has come to the author's attention a communication from the chairman of the accounting committee of the National Association of Railroad and Utilities Commissioners (NARUC) to the Interstate Commerce Commission, in which that committee is reported to favor Method 4, for reasons similar to those expressed by the SEC.

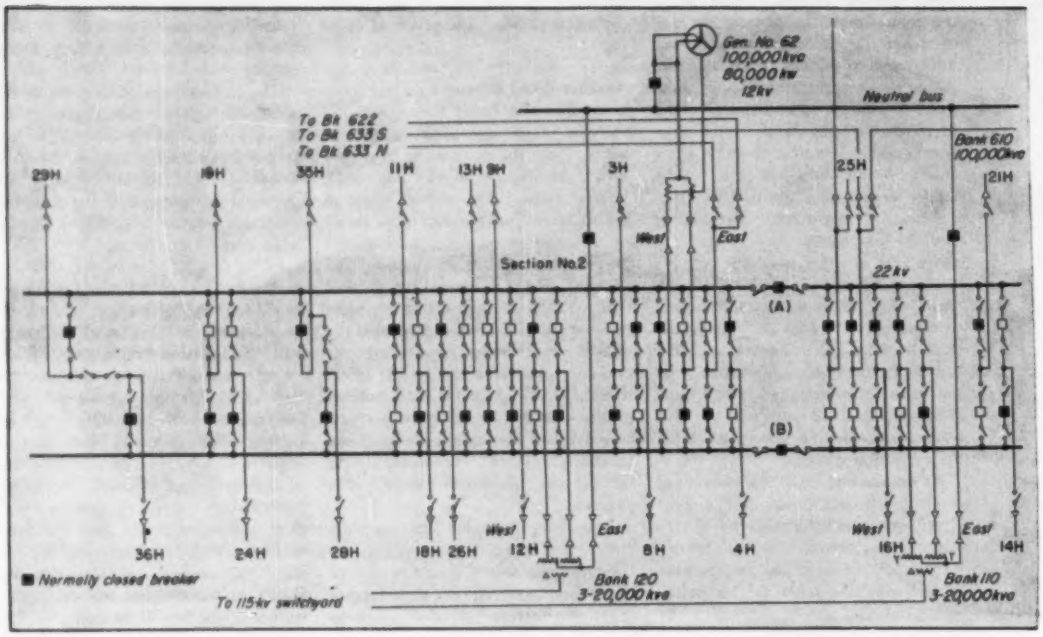


FIG 1—TWO-SECTION BUS at Niagara Mohawk's Huntley Station No. 2 serves distribution substations and two low-voltage networks in Buffalo. For service continuity, individual cables in any group of cables are normally fed from different bus sections. If a breaker fails

Simple But Foolproof Scheme

Inverse undervoltage and inverse ground directional relays protect 22-kv distribution cables against faults that fail to clear. Short clearing time minimizes damage. Installed cost was about $25,000

Back-up protection for a number of 22-kv cables on Niagara Mohawk Power Corp's system is built around three sets of relays for phase-to-phase or 3-phase faults and another group for phase-to-ground faults. The scheme offers these advantages:

1. General application to new or existing installations.

2. Foolproofness with simplicity and relatively low cost.

This scheme uses for each bus three sets of inverse-time, undervoltage relays and a group of inverse-time, ground-directional relays. Installation was made for about $25,000. Although some load may be interrupted under certain fault conditions, back-up relay time is relatively short and fault damage is kept to a minimum.

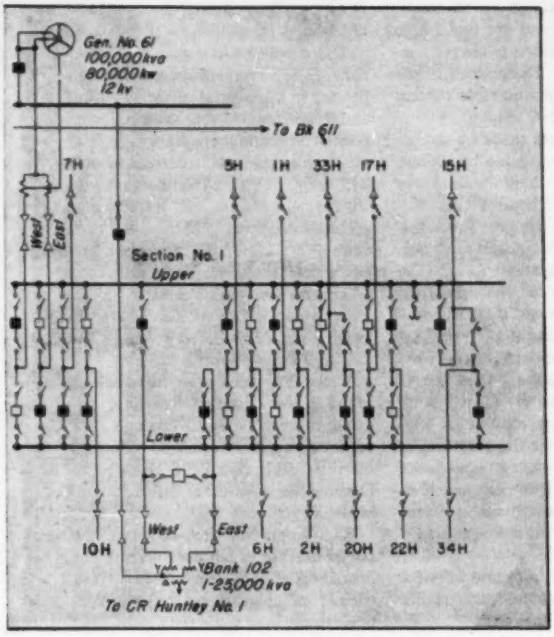
Consider the Problem . . . A large number of distribution substations and two low-voltage networks in Buffalo are supplied through a 22-kv cable system from C. R. Huntley Station No. 2. Single-line diagram (Fig 1) shows the station, bus arrangement, and normal operating position of feeder breakers. Various 22-kv cables are generally operated in groups (Fig 2) to supply distribution substations.* Individual cables in each group are normally operated on different bus sections. Almost all circuits can be supplied from either upper or lower bus sections.

For a bus fault cleared by bus relaying no load will be interrupted because only one cable in each group will be isolated. Individual cable faults will be cleared by their respective relays. However, a breaker failing to open at the generating station could produce very serious and costly consequences. Although fault current from each generating source is relatively small, sufficient total fault current is available which could make the cable useless in 10 to 15 sec.

Each cable is about 10 miles long and could cost possibly $200,000 to replace. This is in addition to cost of repairing or replacing damaged equipment and to the effect a cable outage would have on service.

Analyze the Problem . . . A study of the operating diagram shows the location of various current transformers for protective purposes and instrumentation. Current transformers for circuit protection are located on the line side of their associated breakers. From a protection standpoint, they

* "Fundamentals of Design of Electric Energy Delivery Systems," J. A. Johnson and R. T. Henry, AIEE Transactions, Vol. 53-1934, pp 1704-11.



to clear a faulted feeder, back-up relaying will trip all breakers on that particular section. Back-up relays should permit selective tripping

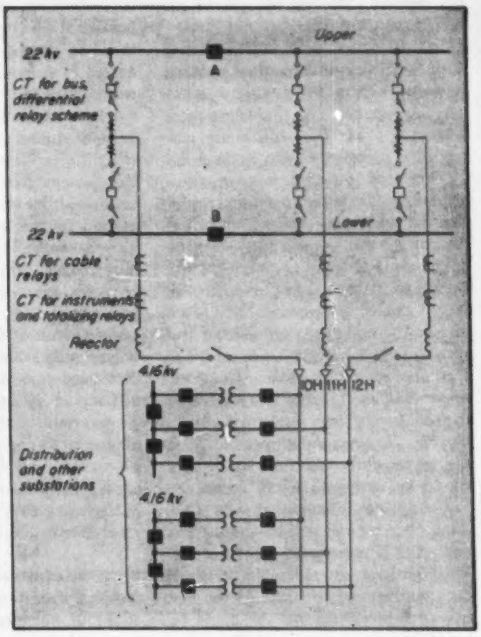


FIG 2—GROUPS OF CABLES feeding distribution substations can be carried by either upper or lower sections of the feeder bus

Backs Up Cable Relaying

GEORGE STEEB, Relay System Supervisor, Niagara Mohawk Power Corp, Buffalo, N. Y.

should be located between the bus disconnecting switch and the breaker. However, to correct this would involve spending about $300,000.

That every phase-to-phase or 3-phase fault causes a voltage disturbance was the clue to the problem. Studies were made of the distribution of phase-to-ground fault currents under various operating conditions. These led to use of inverse-time, ground-directional relays in the secondary circuits of bus-relaying current transformers on tie breakers (A) and (B) in Fig 2.

Undervoltage Relays . . . Because all feeders have inverse-time, over-current relays with instantaneous attachment, back-up undervoltage relays should have an inverse characteristic to permit selective setting. Safeguards have to be provided against accidental removal of voltage.

Undervoltage relays are connected to pick up at 5% below minimum operating voltage.

For instance, a phase-to-phase or 3-phase fault on a cable fed from the upper bus section No. 1 will produce a certain voltage drop. Because the drop on the upper section will be greater than that on the lower, the relatively short-time undervoltage relays will close their contacts and energize the trip coil of tie breaker (A) if the feeder circuit fails to clear.

As soon as breaker (A) opens, voltage will drop further on upper bus section No. 1, whereas other bus voltages will rise. Then a second set of under-voltage relays with 90% pick-up will operate. Contacts of these relays are in series with totalizing inverse-time overcurrent relays. Grouping of cables into eight sets for totalizing overcurrent relays is shown in the accompanying table.

Gang Trip Energized . . . Regardless of which feeder circuit is faulted, with subsequent improper clearing, the respective undervoltage and totalizing overcurrent relays will close their contacts to energize a gang trip after tie

How Cables Are Grouped For Totalizing Relays

Cables Fed from Bus

Relay Group	Section No. 1 Upper	Section No. 1 Lower	Relay Group	Section No. 2 Upper	Section No. 2 Lower
1	22H, 15H	20H, 17H, 34H	5	28H, 4H	3H, Bk 622, Bk 633N
2	21H, 5H	10H, 2H	6	26H, 8H, 29H	13H
3	1H, 33H	6H, 7H	7	35H	9H, 12H, 36H
4	25H, 16H, BkN	14H, Bk611, Bk633S	8	11H	19H, 24H, 18H

has tripped. Neither relay alone can accidentally energize this gang trip.

Third set of undervoltage relays with 50% pick-up have their contacts in series with a "b" auxiliary switch on tie breaker (A). Under-voltage relays on lower bus section are controlled in a similar way by breaker (B).

These relays operate a gang trip if a phase-to-phase or 3-phase fault is delayed in clearing or if a fault occurs on any of the "blind spots"—unprotected areas of upper or lower bus sections and yokes. This type of fault would reduce voltage on the faulted phases almost to zero on one bus and to about 52% on the other. Should this happen on a feeder from the upper bus, tie breaker (A) would be tripped by its own undervoltage relays in 26 cycles. Respective gang trip of upper bus Section No 1 or 2 would be energized in 56 cycles.

Voltage on unfaulted sections after the tie has tripped will be about 69% and 80% respectively of normal. This third set of undervoltage relays does not respond to faults on the line side of feeder reactors. It should be noted that under normal operating conditions bus tie breakers are closed. Therefore, accidental loss of voltage on these relays will not trip anything.

Phase-to-Ground Faults . . . The 22-kv system has all wye points at the generating station connected to a neutral grounding bus through an automatic breaker. On that bus are two 5-ohm resistors, one of which is always connected to ground. Under such conditions, maximum ground-fault current would be about 2,500 amp.

Fault studies were made by considering the various operating conditions. Conclusions from these studies were confirmed by a series of phase-to-ground fault tests. In each case almost 40 to 60% of ground-fault current passed through one of the tie breakers, one way or the other, depending on side fault was assumed.

As a result of these studies, inverse-time, ground-directional relays were used on the tie breaker. These relays pick up at about 20% of maximum ground fault current. Minimum tripping time to energize the gang trip is 40 cycles. All feeder ground faults are normally cleared in not more than 26 cycles by their instantaneous or inverse-time residual current relays.

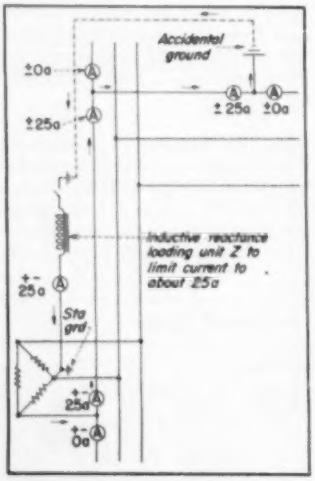
Unprotected Areas . . . Again we must consider phase-to-ground faults on any of the unprotected areas of upper or lower bus sections and yokes. Assume a phase-to-ground fault between an oil circuit breaker, which connects one of the generators to the lower bus, and the disconnect switch immediately proceeding the breaker. Bus differential relay will trip lower bus section No. 1 but will not clear the fault completely. It is outside the generator differential protective zone.

There will be a noticeable difference (2,862 amp) between currents flowing in the neutral of the generator and its autotransformer neutral. Under normal operating conditions, a fault off the bus produces a current of only 813 amp. This and similar analyses led to installation of inverse-time, ground-directional relays in each neutral branch of the generator and power transformers. These relays are polarized from station neutral current transformers. Directional relays selected are not influenced by harmonics flowing through neutral bus.

About 2½ years after this back-up relaying was installed, the first disturbance since 1937 that failed to clear on its own relays occurred. Ground relay on cable circuit 18 H failed to function because of a defective ammeter switch.

Back-up ground directional relay on the tie breaker which controls that bus operated the gang trip. This in turn tripped all breakers on that bus section. Because of some fault resistance, measured* ground current was 1,400 amps and clearing time was 115 cycles. This one disturbance paid in effect many times over the original cost of back-up relay protection.

* "Faults of Three Systems on Single Oscillograph," George Steeb, Electrical World, April 28, 1945, pg 99.



CURRENT LIMITING INDUCTANCE in series with an intermittent test ground and clip-on ammeter locates accidental grounds

Pulsating Current Locates Grounds

P. H. OTIS, Foreman, Electric Meter Division, San Diego Gas and Electric Co

To locate low-resistance grounds on three-phase power secondaries, San Diego Gas and Electric grounds the station transformer ground intermittently through an induction coil and checks the resulting pulsating current in the troubled phase with a clip-on ammeter. The trouble can be traced positively in minimum time.

The method is generally used where a driven ground rod at the transformer does not provide a perfect ground. The induction coil is connected between the ground on the transformer and a positive low-resistance ground, such as a fire plug. Clip-on ammeter indicates the load current plus the intermittent current. This current generally is about 25 amp.

Second test is on the line wire, where the intermittent current indicates the direction of the accidental ground from any junction point. This test is usually made at a corner pole. After checks have been made along the line, fault location may become apparent. Connecting the induction coil to an ungrounded phase and moving the ground along so that current can be applied where the ammeter is being read gives a positive test.

Of several types of loads tried, tapped resistance or induction units have been most satisfactory. Best results have been obtained with an iron-core induction unit consisting of four separate coils which can be connected in series or parallel for 120, 240, or 480 v to give 25-50 amp.

Three Ways to Cut Lamp Replacement

V. L. DZWONCZYK, Operating Sponsor, American Gas and Electric Service Corp, New York, N. Y.

Switches to reduce the number of lamps in operation, use of higher wattage lamps at lower voltage, and installation of fluorescent lamps can materially reduce the cost of lamp replacement. A second advantage of these practices is that they permit the power plant operator to enjoy the benefits which accrue from a properly designed lighting installation.

Lighting Losses . . . Sources of depreciation which waste the initial lighting investment and make lamp replacement necessary may not be fully recognized. These may occur individually or simultaneously:

1. Loss due to lamp aging depending upon type of light source, quality of lamps, and the way in which they are used.

2. Loss due to low voltage depending upon service voltage, circuit resistance, and load on the circuit.

3. Loss due to luminaire inefficiency depending upon arrangement and shape of the luminaire parts as assembled. The arrangement may encourage dirt accumulation causing further rapid decrease in efficiency.

4. Loss due to condition of room surfaces. All surfaces in a room, including walls, ceiling, floor, machines, and tops of furniture, absorb some light. As these surfaces get dirtier, light loss increases.

5. Loss due to dirt, dust, and smoke depending upon working processes in the area, provisions for ventilation, and cleaning schedule used.

6. Loss due to lamp outages depending upon lamp-replacement schedule, number of hours these lamps are burned, and abnormal operating conditions such as excessive vibration, heat, or drafts.

These losses can amount to 70% of available illumination before poor lighting forces corrective measures. Factors 1 and 3 are not wholly controllable by the operator while factors 2, 4, 5, and 6, which contribute materially towards the 70% loss estimate, are controllable.

Reducing Losses . . . One major reduction can be made by not using lamps any longer than required for work and safety. This can be done by providing switching facilities in the lighting systems so that operating personnel can reduce the number of lighted lamps. In this way part or none of the fixtures may be lighted if no one is in the area. Although the value of this arrangement may not be fully realized during construction, savings can be obtained after responsibility for turning lights off and on is established.

A second reduction in losses can be made by using higher wattage lamps operated at reduced voltage (125-v lamps on 115-v circuits). In systems properly designed to produce approximately the same illumination level, longer life can be had with overrated lamps than with lamps rated at circuit voltage.

A third reduction can be made by using fluorescent fixtures where applicable. Such lamps cannot be used in many areas of a power plant because of heat, draft, or obstructions.

Relative Economy . . . Cost of comparable incandescent and fluorescent installations is presented. This comparison is based on number of fixtures, amount of conduit and wire, initial investment, and operating expenses required for a given illumination level in a typical power plant area. These factors determined from data in the tabulation below are significant:

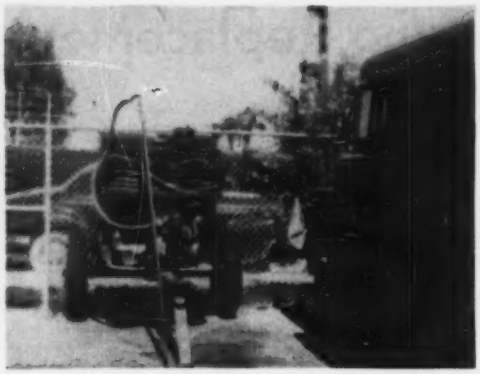
Overall cost per ft-c-year for fluorescent installation is 46.5% less than for Case B and 38% less than for Case A. Investment costs per ft-c are 100: 85.5: 92 respectively for Cases A, B, and C. Annual lamp-replacement costs per ft-c-year, including units and labor, are lowest for fluorescent installation, about 66% less than for Case A. Energy cost per ft-c-year is lowest for fluorescent installation, saving 56%. If the fluorescent system is provided with switching facilities for reduction of illumination, the above costs would be further reduced.

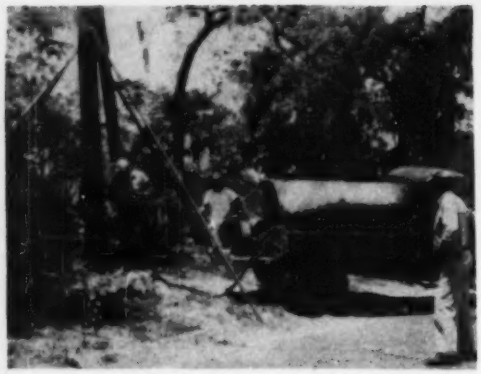
Incandescent vs Fluorescent Lighting Systems

(designed for a 51½x62½x12-ft storeroom)

Specifications	Incandescent		Fluorescent
	A RLM Dome, 115-v lamp on 115 v	B RLM Dome, 125-v lamp on 115 v	C RLM, 115-v lamp on 115 v
Type of fixture	Open RLM	Open RLM	Open RLM
Number of fixtures and lamps	35, 35	35, 35	23, 46
Watts per lamp*	100	200	30
Total operating wattage	3,500	6,160	1,300
Lumens per lamp (rated)	1,630	2,700	2,200
Lamp life, hours	750	1,065	7,500
Fixture investment, dollars	147	175	460
Wiring and installation, dollars	455	455	361
Total investment, dollars	602	633	891
Carrying charges, dollars (@ 15%)	91.00	94.50	123.50
Depreciation and maintenance			
Incandescent @ 10%, dollars	14.70	17.50	
Fluorescent @ 15%, dollars			69.00
Renewal costs per year			
Lamps, dollars	41.30	49.00	35.50
Labor, dollars**	61.30	43.30	16.10
Energy-Costs per year, dollars (@ 6 mills per kwh)	185.00	324.00	121.00
Overall costs per year, dollars	393.30	528.30	365.10
Average illumination, ft-c (maintained)	6.2	7.6	9.2
Expenses per 1,000 sq ft per ft-c			
Investment, dollars	30.13	25.80	27.70
Annual overall cost, dollars	19.90	21.60	12.33
Annual renewal cost, dollars	5.15	3.76	1.74
Annual energy cost, dollars	9.27	13.25	4.08
Relative Indexes Based on Case A			
Investment per ft-c	100	85.5	92.0
Overall cost per ft-c-year	100	108.5	62.0
Renewal cost per ft-c-year	100	73.0	33.8
Energy cost per ft-c-year	100	143.0	44.0

* Ballast loss included for fluorescent lamps.
** Labor taken as $0.15 per incandescent lamp and $0.30 for fluorescent lamp replaced.





Improvements in water-jetting equipment point toward a large-capacity unit and a

Water jetters used by Florida Power Corp evolved in this way; Trailer unit (left) has 250-gal water tank and 1-hp engine driving 35-psi pump; tank-truck model (center has 500-gal tank and 6-hp engine driving 80-gpm, 90-psi pump; improved tank-truck unit (right)

Five Ways to Set Poles In Swampy and Sandy Soils

Three power companies' engineers tell how they meet local conditions using one or more of the following methods:

- **Manual**
- **Power digger**
- **Setting in sewer tile caisson**
- **Water or air jets**
- **Use of explosives**

These five listed methods of setting wood poles in sandy and swampy soils may be used singly or in combination to meet local ground conditions, overcome equipment and supply limitations, and comply with governmental regulations. How each can be used to best advantage is found in the practices and experience of the three power companies.

Setting by Hand . . . Soil in which poles are set on Gulf Power Co's system varies from white, loose, beach sand to a relatively firm yellow clay. Between these extremes is a rather loose sand or a mixture of sand and loam, over much of which tide water flows. There is plenty of river swamp land but practically no rock.

On the distribution system, and for pole replacements on the transmission system, poles holes are dug mainly with hand tools. They are dug quickly in most cases. Then, if the pole has been previously moved into position, it can usually be set before the hole caves in.

A considerable part of Florida Power Corp's system is along the coast where water is only a short distance below ground. This condition is found inland because of many lakes and swampy areas. Holes are dug by hand where the pole can be set before the ground caves in. Hand digging is used on small jobs and when a power hole digger is not available or cannot be spotted to pole location.

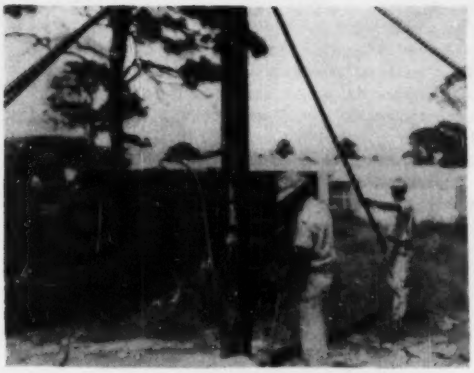
Use of Power Digger . . . Diggers are in general use on Florida Power's system and dig holes quickly in hard or dry sandy soil not subject to cave-in. They are used to good advantage in swampy and sandy soil. In most instances a good operator can dig a hole and not disturb the sides while lowering or raising the auger. With a little care the pole can be set before cave-in occurs. Sometimes holes are made deeper than necessary to allow for the cave-in.

Power diggers are used to install screw-type anchors. An attachment fastens to the end of the auger and over the anchor eye. It can also be used to remove one-piece screw-type anchors. On one job 27 anchors of the 10-in. screw type with 8-ft rods were installed in 15 minutes each.

Sewer Tile Caisson . . . Difficult construction problems were overcome when Kansas City Power & Light Co had to set poles for a 154-kv line in quicksand of Missouri River bottom lands and string conductors over railroad tracks which crossed the area on high fills. New circuits were of conventional two-pole H-frame design with 750,000-cir mils copper conductors.

Break-off structures were of three-pole design with 110-ft poles set 22 ft apart. To set these poles in quicksand, 4-ft sections of reinforced concrete sewer tile of 42-in. inside diameter were used. One sewer tile was set on end. As a pole-hole digger removed the sand from beneath the pipe, it dropped. When the top reached ground level, a second section was set on the first. The process was continued until four tiles were in the ground.

The bottom of the hole was grubbed out with a clam



minimum of operating difficulty

has 800-gal tank and 50-gpm pump driven by truck power take-off. Pump engine is eliminated from latest jetter unit

W. L. PILSBURY, Supt of Transmission Construction & Maintenance, Florida Power Corp, St. Petersburg

JUDSON GILLESPIE, Transmission Engineer, Gulf Power Co, Pensacola, Fla.

S. H. POLLOCK, Assistant Superintendent, Overhead Dept, Kansas City Power & Light Co, Kansas City, Mo.

shell bucket. Workers rode up and down on the clam shell to finish the inside of the hole.

Piles were driven into the holes to depths varying from 22 to 44 ft to give the desired bearing resistance. A small tree saw was used to level the piles at the bottom of the hole. A 3-ft plug of concrete was poured into the hole to provide a firm base. Holes were capped with wooden covers while the concrete set.

A "swamp boot" was used on some suspension poles where there was quicksand under firm top soil. A ½-in. steel plate was put under the pole butt. Rods were run from the plate to a yoke of creosoted timbers on the ground. Yoke was covered with dirt to finish the job.

The quicksand area had previously been covered with from 2 to 4 ft of earth to allow use of heavy equipment.

Water and Air Jets . . . Florida Power Corp uses water jets with various types of equipment to set poles in sandy or swampy soils. One jet outfit consists of several hundred feet of 2½-in. pipe and hose and a jet pipe made of 1-in. pipe flattened at the end. This produces a very good stream of water for jetting and cutting through hard pan. Poles can be jetted-in quickly. It takes about 500 gal of water to set a pole to the required 8, 9, or 10-ft depth. This equipment is still in use. Water for this outfit is obtained from city fire hydrants through portable water meters.

Florida Power also has a two-wheel trailer unit which consists of a 250-gal water tank and a 1-hp engine for jetting at about 35 psi. Although the idea was very good, the equipment was too small and trouble was experienced in starting the gasoline engine. The succeeding unit was mounted on a truck using a 500-gal tank. But trouble still was experienced in starting the small pump engine. To eliminate this trouble, a pump driven through the truck power take-off is used on the latest unit. This jetter has an 800-gal tank and a 50-gpm pump.

This pole-setting job illustrates use of the jet method. A five-mile section of 66-kv transmission line was constructed across an open bay. This section consisted of 39 H-frame structures ranging from 55 to 75 ft high which had to be set in water from 2 to 9 ft deep at low tide. The soft bottom of the bay made it necessary to set the structures from 12 to 16 ft in the ground with 30-ft bog shoes to hold them in lace.

Four small portable 40-psi pumps were placed on a barge which carried the H-frames. Two jets per hole were used as each structure was lowered into the ground. Simultaneously two jets were used to dig a ditch under the bog shoe. In this way the complete structure could be lowered until the bog shoe position was 18 in. below ground level.

Contractors Use Air . . . Florida Power Corp has not set poles using air jets although several line construction contractors have done so in wet and sandy locations. They report there must be sufficient water in the hole so that the air will stir up and puddle the soil. If the pole is rocked back and forth it will sink gradually to desired depth. This air-jet method cannot be used where extra hard soil or hard pan is encountered .

In the Pensacola area of Gulf Power Co, the water jet is used frequently because a city ordinance prevents the use of explosives. In suburban areas there is the danger of damaging water or gas lines if explosives are used. In the rural areas around Pensacola water jet is used mainly because the pole setting crew has the equipment and finding a source of water is rarely a serious problem.

To set the pole using a jet of water, the pole is set in a shallow hole using a truck and A-frame derrick and guyed four ways. The water jet is played next to the pole butt while the pole is rocked from side to side. A 35-ft, Class 5 pole can be set to a depth of 5½ ft within about 5 minutes using 250 gal of water.

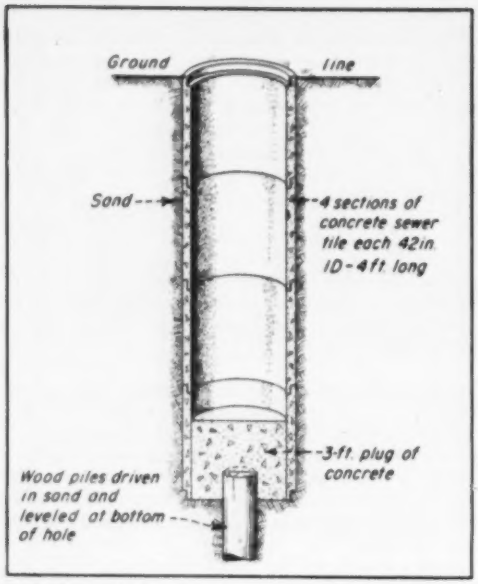
Gulf Power's equipment includes a second-hand tank, which was cleaned, painted, and had skids attached, and about 15 ft of 2-in. hose and 15 ft of 2-in. steel-reinforced suction hose. The pump is a 2-in., self-priming, 10,000-gph, centrifugal, portable pump. It was purchased complete with strainer for $285. Total cost of equipment was under $500.

Nozzle for the jet is a 7 or 8-ft length of 1 or 1¼-in. pipe with one end flattened out and the other bent 90 deg to accept hose fittings. This bend provides a convenient handle for working the pipe beside the pole.

The tank is carried on a flat bed, 1½-ton truck. It is loaded by the crew. If only one or two poles are to be set at a location near a source of water, only a couple of empty, 55-gal oil drums are carried. Any convenient stream, pond, bayou, lake, or bay serves as a source of water, although water is often obtained from a fire plug.

Greatest disadvantage of setting poles by high-pressure water jet is the problem of keeping enough water at the pole location, regardless of the relative convenience of supply. Even though the pump or a fire plug will rapidly fill a 400-gal tank, this filling takes time and so does driving to and from the source.

Cost per pole is not readily obtainable. However, it is not excessive and is in line with usual methods used to set distribution poles. This method has been found to be far

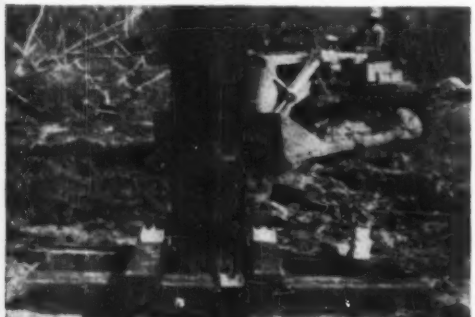

Ground line
Sand
4 sections of concrete sewer tile each 42in. ID - 4 ft. long
3-ft. plug of concrete
Wood piles driven in sand and leveled at bottom of hole

CAISSON formed by sections of sewer tile provides firm foundation for 110-ft poles set in river-bottom quicksand by Kansas City Power & Light. Dirt was placed around poles set in caisson

superior to digging through a barrel or cribbing.

Use of Explosives . . . Transmission line pole replacements in sandy and swampy soil on Gulf Power Co's system are made using dynamite. Regardless of conditions, a hole usually can be dug at least 2 ft deep. The pole is erected and guyed four ways. If the new pole is hard against the old pole, light charges are used for safety. A half stick of dynamite 12 to 18 in. below the pole butt will shoot the pole down that deep or a little deeper. This is repeated until the desired depth is reached.

The main problem is loading the charge. One way is to sink a piece of 2-in. pipe by means of a sand pump. This device consists simply of a 3-ft steel pipe with a ball and socket valve inside the lower end and a small bail or handle at the top. The sand pump is "chugged" up and down inside the pipe by a wire tied to the bail. When the pipe reaches the proper depth, the dynamite charge and electric detonator are inserted with a long stick. The pipe then is pulled out over the detonator wires. The charge is set off by one flashlight cell.



SWAMP BOOT was used by Kansas City Power & Light on some poles where firm top soil was underlaid with quicksand. Criss-crossed creosoted timber support rods which run down to ½-in. steel plate that is placed at the bottom of the hole under pole butt

Sinking the Loading Pipe . . . A piece of 1½-in. pipe with a solid steel point welded in one end and a pipe tee and two pipe handles 18 to 24 in. long on the other is a better tool for way of sinking the loading pipe. It should be at least 6 in. longer than the loading pipe. With the loading pipe set up beside the pole, the driving pipe is inserted, raised a couple of feet, and then pounded down.

Another way to load has been used in white, loose, beach sand. The threaded end of an ordinary locust pin is sharpened and the shank is inserted into a 7 or 8-ft piece of 1½-in. pipe. The locust pin and pipe are driven into the sand about 6 ft. Locust pin is driven out of the lower end after which the charge is loaded and the pipe pulled.

Setting H-Frame Structure . . . For new transmission lines in the area from the Gulf Coast to 12 or 15 miles inland, two-pole, H-frame structures are set with explosives. These structures are equipped with associated crossarms, hardware, and suspension insulators. Success of this method depends on the experience and skill of the man loading the holes.

The line usually is designed to allow structures in swampy locations to be set as much as 4 ft deeper than specifications. Quite often a 65-ft structure drops to a depth of 12 ft when the charges are set off simultaneously. If one pole drops a foot or so deeper than the other, a light charge is fired under the high pole. Occasionally one pole of the structure has to be lifted.

In a few instances, but not as a general practice, 12-in. screw type swamp anchors have been successfully installed with the aid of explosives where quicksand and water are present. These anchors have 2-in. extra-heavy pipe as anchor rods. This pipe comes in 10-ft sections, but in quicksand an anchor installed 5 ft into it will hold forever.

The anchor is started in the usual manner until it refuses to turn. Then a quarter stick of dynamite is loaded right behind it. With four 48-in. Stillson wrenches on the pipe and as many men on the wrenches as possible, the charge is set off and the pipe turned rapidly. Perhaps one complete turn will be made. This is continued until the anchor is installed.

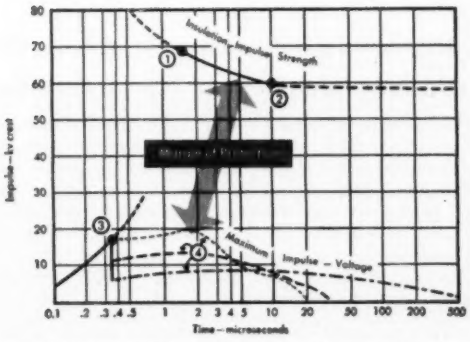
Explosives are used by Florida Power Corp in setting some transmission poles and distribution poles in sparsely settled areas and where no power digger is available. This method is used where poles are set in water or in quicksand and cave-in type coils.

The hole is dug and a pipe is driven in the center of the hole and cleared of sand with an auger. Dynamite charge is placed in the pipe and held in place by a wooden rod as the pipe is removed. The pole is set with four guy ropes to keep the pole vertical. After the truck is moved but with slack winch line attached, charge is fired.

Poles that don't drop can be rocked back and forth until they break through and sink into the hole. If this fails, another charge is used. The loading pipe is set at a slight angle so that its end is under the pole at the proper depth.

G-E PELLET ARRESTERS are also unequalled in durability—they're the only distribution arresters with series gaps sealed in dry, inert nitrogen. Gap electrodes stay bright as new. The Pellets, themselves, are unaffected by service moisture.

No other distribution arrester protects so well



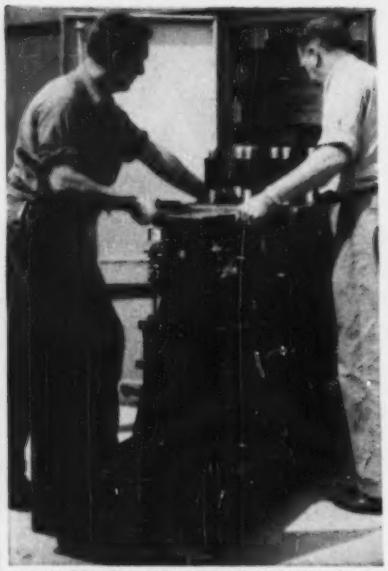
THIS GRAPH was made from actual volt-time and ampere-time oscillograms, and from AIEE standard test data. The demonstrated impulse strength of 2400-volt distribution transformer insulation is represented by the curve passing through: (1) the minimum impulse strength on an AIEE standard chopped wave test, and (2) the minimum impulse strength on an AIEE standard full-wave test. The impulse voltage allowed by a 3-kv General Electric Pellet Arrester is determined by (3) the impulse sparkover voltage of the arrester on the AIEE standard test wave, and (4) the IR drop across the arrester to ground with (top line) a 65,000 ampere discharge—(middle line) a 20,000 ampere discharge—and (bottom line) a 1500 ampere long duration discharge. The arrows show the unequalled margin of safety.

HERE'S THE EVIDENCE. The graph at the left, from actual volt-time and ampere-time oscillograms, shows the unequalled margin of safety that a 3-kv General Electric Pellet arrester gives a 2400-volt distribution transformer. Higher rated arresters, protecting higher-voltage transformers, similarly show this unequalled margin of protection.

HERE'S THE REASON. This extra protection results from a combination of low sparkover voltage and exceptionally low IR drop. Whether lightning currents are high or low, with durations long or short, no other distribution arrester holds voltages to such low levels.

HERE'S YOUR CUE. The Pellet is a valve-type arrester for universal use on urban, rural, or industrial systems. It is available in ratings of 1 kv to 15 kv inclusive. This arrester has been the quality-standard for over 25 years—it's your cue for maximum protection. For further information contact your G-E representative or your authorized G-E agent. *General Electric Company, Schenectady 5, N. Y.* 45-41

GENERAL ELECTRIC



EASILY REMOVABLE CIRCUIT BREAKER facilitates inspection or replacement. This *vertical-lift* breaker cannot be moved in or out of operating position unless contacts are open.

AUTOMATIC G-E LOAD-RATIO-CONTROL unit eliminates separate voltage regulator. Control panel shown above has raise and lower push buttons, position indicator and operations counter. Some G-E LRC units have made over 1,000,000 tap changes without appreciable wear.

Utility finds quick answer to growing loads with G-E Packaged Substations

QUICK INSTALLATION: This G-E substation for the Western Massachusetts Electric Co. was trucked directly to site of installation, bolted to waiting foundation, connected to high-side and feeder cables, and placed in operation.

Standardized factory-assembled substations simplify utility expansion.

Faced with rapidly growing loads on one side of Pittsfield, Mass., the Western Massachusetts Electric Company found a ready answer when it ordered and installed the G-E unit substation shown at left. By selecting a standard unit directly from G-E specifications, it not only got quick delivery of a complete, ready-to-operate substation, but also saved time and money all along the line—from initial planning through to final installation.

When the need for further substation capacity developed on the opposite side of town, standardized equipment again was the answer—even to the necessary steel structure, as shown in the photograph on the opposite page.

The trend to standardized equipment, as the logical cost-saving way to meet growing loads, is evident in utility expansion programs across the country. Because of their great flexibility, G-E unit substations are applicable to a wide variety of system arrangements. For full information, write for Bulletins GEA-3800 and GEA-4500. *General Electric Co., Schenectady 5, N. Y.*

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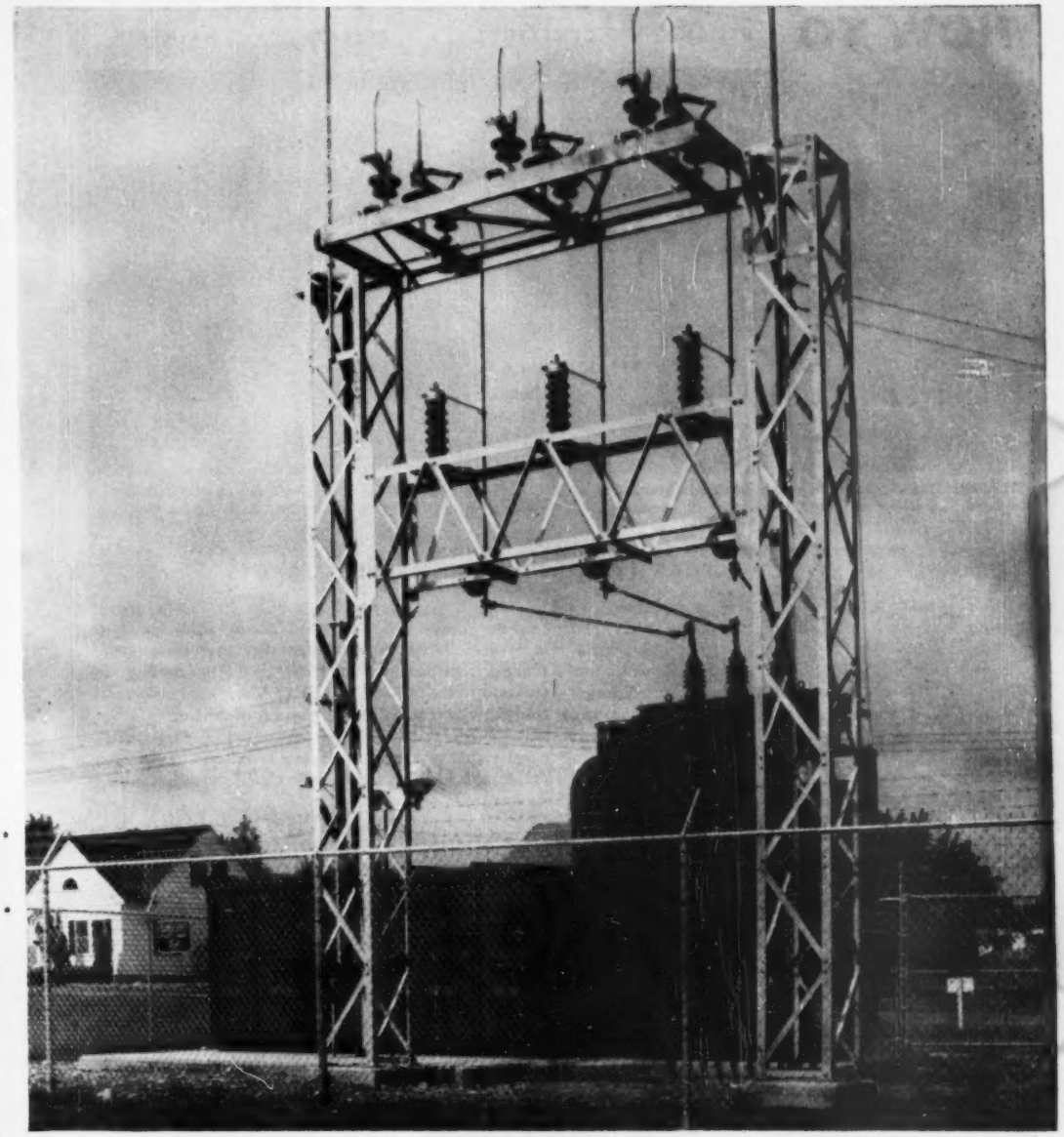
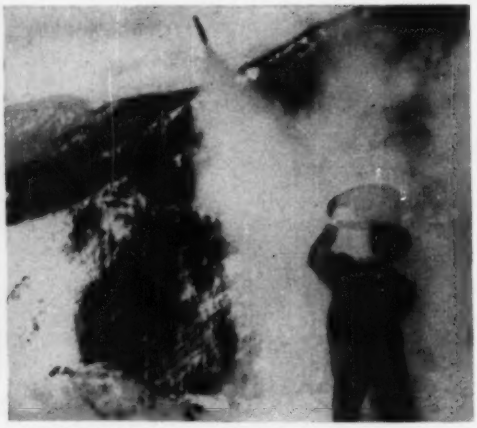


EVERYTHING STANDARD—INCLUDING THE STRUCTURE: One of the latest substations installed by the Western Massachusetts Electric Company, this unit was supplied complete, even to the steel structure for the incoming high-voltage lines. Standardized equipment like this eliminates weeks of detailed planning and engineering, simplifies purchasing. Trained engineering personnel have more time for the important work of broad system planning. The trend is to "standards"!

GENERAL ELECTRIC

SELF-PROPELLED MISSILE (left) carries light leader attached to line in barrel. Launching tube, right, has pistol grip, protective shield



PEACETIME BAZOOKA for carrying lead lines over bad terrain takes off on trials by Washington Water Power Co on Cabinet Gorge line

Shoot Lead Lines Across Tough Terrain with Rockets

An adaptation of the wartime-developed bazooka for carrying lead lines over difficult terrain has been tried by Washington Water Power Co. The device uses a hand-launched, rocket powered missile to carry the small line over ravines or other obstructions. It was first tried during construction through mountainous areas of the company's 110-kv line from the new Cabinet Gorge plant in northern Idaho into Spokane.

In operation, the missile is launched from a bazooka-like tube which mounts a circular shield midway back to the pistol grip by which it is fired. Pulling the trigger fires the missile which takes off slowly, gathering speed as it goes. Experience showed that best performance resulted from having about 100 ft of the line laid out on the snow so the missile could get up some speed and power before it was required to pull the rest of the line.

Directional accuracy of the missile was good, although range varied a great deal depending on how much of a start it could get before taking on the full load of lifting the line from the barrel.

Colored Plastic Strips Speed Map-Board Operation

DISTRIBUTION MAP-BOARD using eight colors of plastic strips on white painted plywood makes operation easier and faster, increases flexibility and is easily cleaned

M. N. TOWNSEND, Engineer, Service Dept, Mississippi Power & Light Co, Jackson, Miss.

The operation of our Jackson distribution system has been made easier and faster with the construction of a map-board using a colored plastic strip. The strip is 3/32 in. wide and is available in 100 yd spools, with nine colors including white and black. This provided eight colors in a material that would be easily put up, removed or changed. Eight colors seemed feasible since each of the three substations had only six feeder circuits and two more per substation provided ample room for growth.

The strip is fastened to a white painted plywood wall with a stapling machine, used in the open position. The material cost was less than $10.00.

With the available wall space, a map 500 ft to the inch was selected.

Class I Accuracy Controls now standard on these G-E Regulators

General Electric's Type IR5 single-phase induction voltage regulators (shown above) and the three-phase Type IRT's provide the finest regulation obtainable for heavily loaded, urban feeders.

Highly accurate controls that decrease voltage spread—permit your feeders to carry more load . . . at no extra cost

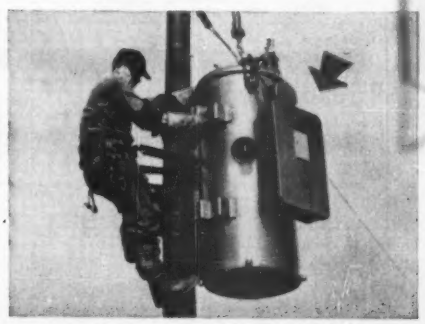
Today, with power demands on your feeders rising, the increased accuracy of these G-E voltage regulators becomes a significant system design tool.

The controls on these regulators meet rigid ASA Standards for Class I accuracy. They have an *over-all* error of not more than ± 1%—99% accuracy—regardless of operating changes in temperature, frequency or load.

As a result, when you use these G-E regulators, you can tolerate more drop in your regulated feeders without at any time exceeding established voltage limits. Your existing feeders can carry heavier loads for greater distance. And your new construction can be designed with this increased load-carrying capacity in mind.

For further information on what Class I accuracy can mean to you, write for GEA-5690. *General Electric Company, Schenectady 5, New York.* 404-87

General Electric's Type MLT32 step voltage regulators are ideally suited for three-phase circuits that require close, accurate voltage regulation.



General Electric's Type ML32 single-phase step voltage regulators permit you to set new standards of regulation on your branch and rural circuits.

GENERAL ELECTRIC

This made the map large enough to read and allowed all but two of the rural lines to be included on the board to scale. These two lines were "shrunk" so they would be shown also. Conventional map symbols were used as far as was possible. Since all lines were to be either 13.8-kv three-phase or 8-kv single-phase, no distinction was made between these lines. Each circuit was made up of one color from source to end or to tie station. These circuits were numbered on the board to correspond with OCB numbers. The color of each circuit was worked out so that only one line of each color originated from each substation, and these colors were worked in to tie in with five underground circuits that had been previously color coded. A decorator's tape was used on the adjacent control panels to make the circuits correspond in color.

In constructing the board, a map was assembled and taped to the wall. The circuits were then stapled loosely to the wall over the map. The paper map was then slipped from under the plastic strips and the strips nailed down firmly. A make-up rubber stamp was used to name the streets and substations, and to number the circuits. Colored pins are used to indicate the position of switches shown on the board. Everything about the board is washable so that it is easily kept clean.

New LRC Performance Test Is Fast and Reliable

S. MINNECI, Power Transformer Engineering Div, General Electric Co, Schenectady, N. Y.

A new test method for checking operation of mechanical components and interconnections between electrical elements of load ratio control equipment has these highlights:

1. Testing at normal operating speed of tap changer saves time.

2. Cutting into transformer power circuit is unnecessary.

In addition, the new method eliminates the danger of making a wrong connection that was present in the former method which used 110-v indicating lamps connected to various points in the transformer winding. The possibility existed for two wrong connections to give the appearance of a correct connection.

According to engineers of General Electric Co, who developed the new test method, it insures that the various mechanical components operate in the proper sequence and that correct interconnections are made between transformer and reactor windings, tap selectors and arcing contactors.

In the new method, which has been adopted as General Electric's standard test, transformer is excited and current input to its terminals is recorded continuously on paper as load ratio control equipment is operated over its entire tap range at normal speed.

Because sufficient power is usually unavailable to test the transformer at rated volts and amperes, the test is made (1) with rated voltage only. In this portion the recording is examined for abnormal increases in current; (2) with rated current only. In this portion the recording is examined for abnormal decreases in current. On three-phase transformers, a recording is made of each phase for comparison.

Examples of normal and abnormal circuit conditions are typified by patterns shown in the illustration.

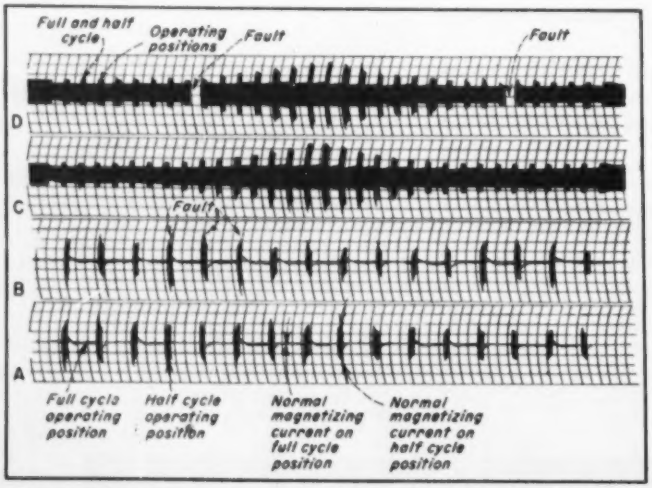
Pattern A shows a normal current with rated voltage applied to transformer. Note periodic and gradual change in current amplitude as tap changer moves through bridging or half-cycle operating position.

Pattern B shows an abnormal current with rated voltage applied to transformer. Note that magnitude of current is greater on some bridging positions than on others. This fault condition was deliberately created by interchanging two connections between transformer winding and tap selector switch on one phase only of a three-phase transformer.

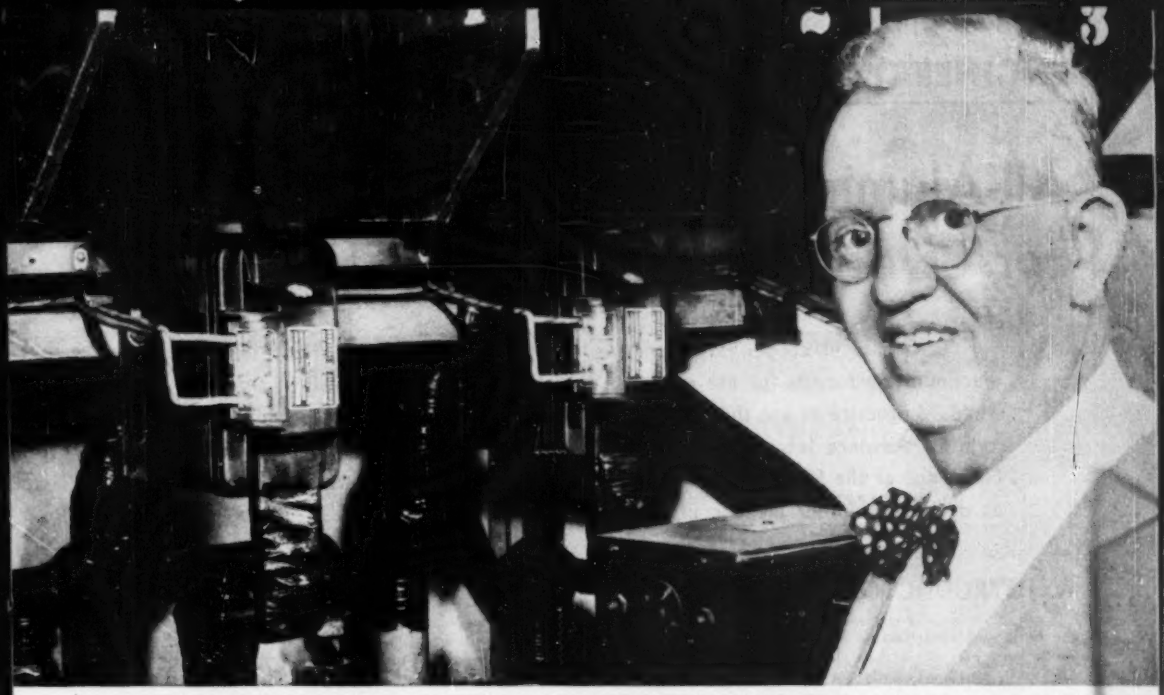
Pattern C shows a normal current with rated current applied to transformer. In this case current is periodically reduced due to the increased impedance introduced into transformer circuit during interval that current is flowing through only half of bridging reactor winding.

Pattern D shows an abnormal current indicated by sudden discontinuities. This fault condition was deliberately created by disconnecting a connection to one of two stationary contacts on only one position of tap selector switch.

Since this new test method was put into practice, these faults have been uncovered: Reversed connections in one phase between LRC and a three-phase bridging reactor; bouncing of arcing contacts; faulty operation of LRC because ends of a cotter pin had not been properly spread; and omission of a connector between studs on LRC contactor panel.



RECORDING PATTERNS are reliable guides to normal or abnormal circuit conditions in load ratio control equipment. Pattern A indicates a normal current with rated voltage applied, while pattern B shows an abnormal current at rated voltage. With rated current applied, normal current is shown in pattern C and abnormal current in pattern D



MR. R. A. HOWE OF WELLESLEY ELECTRIC LIGHT RECOMMENDS JKM-3 TRANSFORMERS BECAUSE OF DESIGN FEATURES AND QUICK SHIPMENTS.

"Why We Use G-E Butyl-molded Transformers"

"Stock shipment, greater load capacity," reports Wellesley Electric Light Dept.

"We like the sustained accuracy, dependable service, and neat appearance of General Electric's Type JKM-3 *butyl-molded* current transformers," says Mr. R. A. Howe, Superintendent, Electric Light Department of the town of Wellesley, Mass.

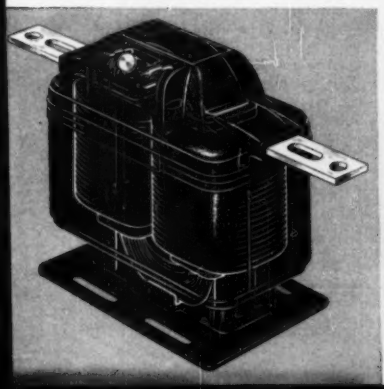
Mr. Howe reports, "The JKM-3 carries 150 per cent of rated current continuously (800-ampere design carries 125 per cent). It has a longer life than conventional transformers without any premium in price. The molded butyl provides better insulating material, excellent heat dissipation, and high dielectric strength.

"Especially important," he adds, "We can buy the 5000-volt JKM-3's directly from stock in 10- to 800-ampere ratings."

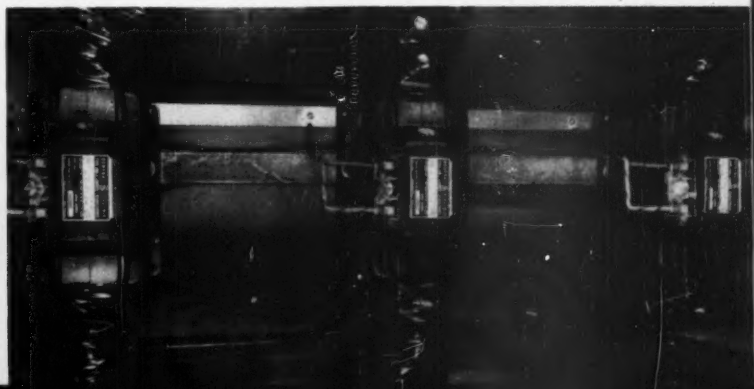
For complete information, contact your nearest G-E representative today or write for bulletin GEC-497. General Electric Company, Schenectady 5, New York. 630-33

GENERAL ELECTRIC

MOLDED BUTYL around coils makes unit mechanically sturdy, helps assure long life.



EASY-TO-INSTALL butyl-molded transformers are mounted in one of this utility's installations. The JKM-3 indoor current transformer is stocked for quick delivery. Why not order now?



All-Aluminum Conductors For Overhead Line Construction

Scarcity of copper has prompted development of specifications for all-aluminum conductors for use on urban distribution where previously it was not standard practice to use this conductor. Specifications are being prepared in the form of "Advance Information Sheets" for Detroit Edison Co distribution manual. First page of the Sheets has been issued and an adaptation is presented for use as a guide by other electric utilities.

A. INTRODUCTORY

A critical shortage of copper has forced the purchasing of aluminum conductors for a large part of overhead lines use. For some uses, particularly for service drops, there is a substantial saving of money to be made by the use of aluminum.

The purchase of aluminum in those wire sizes forming the bulk of the needs will permit continuing the construction program.

This sudden switch to aluminum has not permitted the gradual development of specifications that is preferred to follow with new items. Suitable hardware items for aluminum conductors are also difficult to obtain because of previously small production.

Specifications for the use of this new wire are being issued as a set of "Advance Information" pages because:

1. It will be more convenient to have this information in one place until the field groups become familiar with new items and construction practices.

2. Revisions can be made more readily as field suggestions and new hardware items develop. Designs can be made more nearly final before revising the various sections in construction specifications.

B. SIZES AND USE

For the present, four sizes of wire are being furnished in aluminum.

No. 4 Aluminum Triplex—This will be used system-wide in place of No. 6 triplex copper for practically all residential and commercial 3-wire service.

No. 1/0 Aluminum 4/16-in. Neoprene wp—This will be used system-wide in place of No. 2 neoprene or braid-covered copper for new extensions, particularly large scale housing developments. Use of No. 1/0 aluminum for secondaries where large numbers of copper services exist should be avoided. The shorter limiting span length, 200 ft for No. 1/0 aluminum, should be noted.

No. 3/0 Aluminum, $\frac{4}{4}$-in. Neoprene—This will be used system-wide in place of No. 1/0 wpx or wp for new extensions. Use of aluminum secondary where large quantities of copper services exist should be avoided.

350,000 cir mil Aluminum wp—This will be used system-wide in place of No. 4/0 copper for lines at primary voltage.

In addition to these sizes of covered all-aluminum conductors, 477,000 cir mil bare ACSR will be used on certain 24/40-kv lines of large capacity.

C. SUBSTITUTION

For the present, both copper and aluminum will be available in equivalent sizes. The following procedure has been agreed upon.

1. New Jobs—These should be designed on the basis of aluminum except where definite economy can be effected by the use of copper with longer spans. On such jobs designed for copper where aluminum use is not desirable or possible, the words "copper only" shall be added on the Bill of Material.

2. Jobs Already Issued—When copper of a given size is down to a month's supply at any given warehouse, the Stores Dept shall inform the Chief Estimator. Outstanding jobs for that size of copper shall be reviewed on the basis of aluminum substitution. Where aluminum cannot be substituted without major redesign, the job shall be marked "copper only." The limitation "copper only" should appear at the top of all copies of the Department Order and the conductor bill of material. After notification from Overhead Lines Dept that the review is completed Stores Dept may proceed with aluminum substitution except on jobs marked "copper only."

3. Whenever aluminum is substituted for copper, the foreman shall so indicate on his job sketch, as "3 No. OAAX," or whatever size is concerned.

D. INSTALLATION

In connection with construction specifications the following points should be noted.

1. Under certain conditions of moisture and atmosphere, aluminum and copper will form an electric cell, with consequent erosion of aluminum. Bare aluminum must be kept separated from bare or old weatherproof copper.

2. A transparent coating of non-conducting oxide forms on aluminum when this metal is exposed to air. To secure a good lasting electrical contact at splices or taps on aluminum, the aluminum wire shall be coated with a film of corrosion inhibiting grease and then brushed with a wire brush or 2/0 emery cloth. The grease will prevent the oxide from reforming. With splicing sleeves which do not contain inhibiting grease, the conductor should be greased and brushed where sleeve contact will be made. These procedures apply to both bare and covered wire.

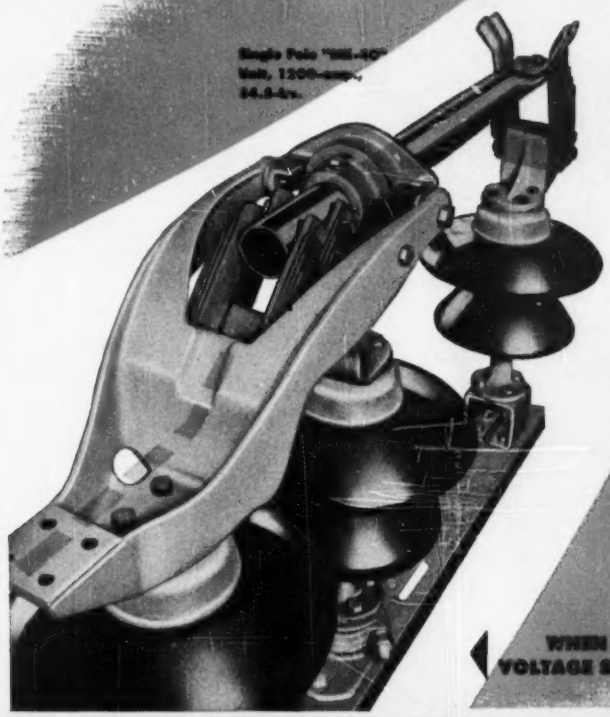
3. Where splices are made with preformed splices (similar to preformed armor rods) the covered aluminum conductor must be skinned, coated with inhibiting grease and cleaned before the preformed splice is applied. The grease not only prevents the oxide from reforming but will also assist in installing the splice rods.

4. Where preformed deadend ties are applied, the conductor must be skinned. Inhibiting grease is not necessary here for oxide control, but will assist in easy application of the preformed deadend tie. It does not affect the holding power of the deadend or splice.

Methods for making: (1) 350,000 cir mil aluminum conductor deadends, splices, taps, and ties and (2) aluminum triplex service connection at building entrance, will be outlined in ensuing issues.

Let's Look at the "MK-40" CURRENT PATH

Thruout the entire range, from 400 to 5000 amperes and from 7.5 to 230-kv., the current path of the "MK-40" is designed with a minimum number of current interchange surfaces. High pressure silver-to-copper contacts are used at both ends of the tubular floating blade—the simple and logical way to eliminate flexible shunts. All parts are in plain view for visual inspection.



Single Pole "MK-40" Unit, 1200-amp., 34.5-kv.

ONLY THE "MK-40" HAS ALL THESE FEATURES

1. Both ends of the blade have the same type of reliable high pressure silver-to-copper contacts backed by sturdy beryllium alloy springs. Current carrying function of the contacts is independent of the pressure applying members.

2. There are no other springs or moving contact surfaces; no small parts.

3. The number of current interchange surfaces is reduced to an absolute minimum. Hinge pins do not carry current.

4. All of the few parts in the current path are in plain view for visual inspection.

Plus of course—smooth ease of operation with blade under full control at all times; locking in both opened or closed positions.

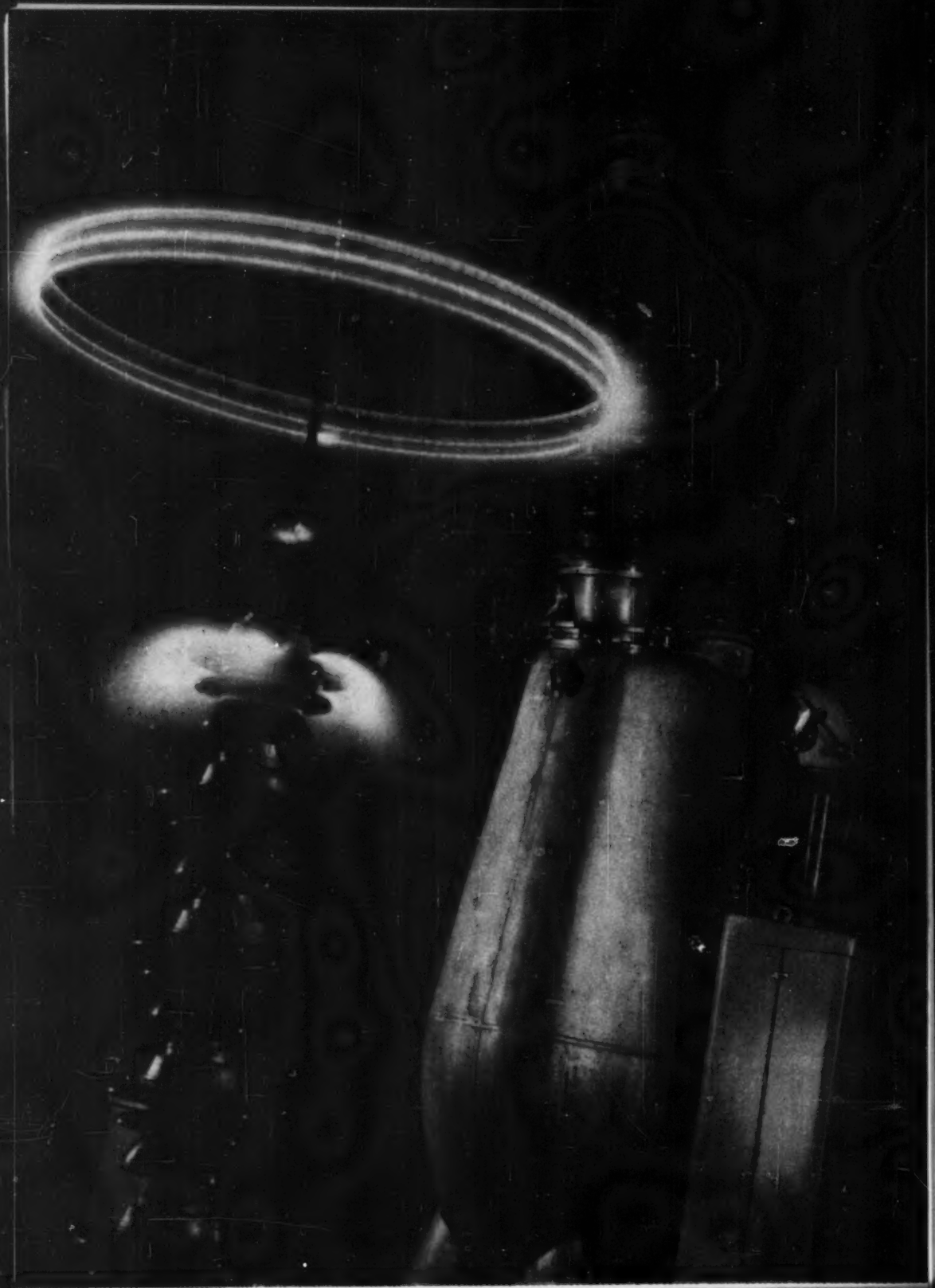
WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHES SPECIFY THE "MK-40"

DELTA-STAR ELECTRIC COMPANY

DIVISION OF H. K. PORTER COMPANY, INC.

2437 Fulton Street • Chicago 12, Illinois

DISTRICT OFFICES IN PRINCIPAL CITIES



Meeting the Nation's Growing Power Load

Greater System Capacity through new and higher Breaker Ratings

Heavy-power concentrations and extensive system interconnections have created demands for circuit breakers with unprecedented characteristics and ratings. Yesterday 10,000,000 kva for 230,000 volts looked like the ultimate . . . today we are approaching 15,000,000 kva. Westinghouse has developed and already has installed other new and higher ratings for a wide range of voltages.

What's the meaning of these new ratings? Higher voltages will carry larger power blocks more economically. Higher interrupting capacity makes greater concentration of generation or of transmission lines at one location possible. With the same system stability, extra transmission lines and current-limiting reactors are eliminated.

Westinghouse started getting ready for these new interrupting peaks 27 years ago, when the High-Power Laboratory was created. The facts gained from thousands of short-circuit tests . . . proving ratings as high as 10,000,000 kva . . . have enabled us to reduce breaker operating time, size, and amount of equipment to do the job.

It's another example of Westinghouse thinking ahead. It's an awareness of all utility needs . . . keeping breaker capacity, for example, in step with system expansion, so that your investment in generating and transmission facilities can be protected. With the realization that America's power appetite is growing, marches our responsibility to build apparatus . . . that is more efficient, economical and reliable. J-97162

YOU CAN BE SURE . . . IF IT'S

Westinghouse

New ratings available

Since 1945 Westinghouse has developed the following new circuit breakers:

34.5 kv, 2,500,000 kva
69 kv, 3,500,000 kva
115 kv, 3,500,000 and 5,000,000 kva
138 kv, 5,000,000 and 10,000,000 kva
161 kv, 5,000,000 and 10,000,000 kva
230/196 kv, 10,000,000 kva

Westinghouse is the first company to build and have installed 161-kv, 10,000,000-kva breakers. 230-kv, 10,000,000-kva breakers already have several years of field experience. Westinghouse also will soon deliver a substantial number of 138-kv, 10,000,000-kva breakers.

Westinghouse also has converted existing breakers to ratings of 10,000,000 kva by changing to new interrupters . . . extending the useful life of present equipment.

New pneumatic mechanisms

Modern power requirements call for high-voltage circuit breakers capable of initial reclosure in 20 cycles or less. The newly developed Westinghouse pneumatic-operating mechanism combines high-speed reclosing with mechanically trip-free opening so that the breaker cannot be held closed after a tripping impulse has been given. Further, latches are reset so rapidly that subsequent reclosures are possible after intervals only a little longer than the initial reclosure.

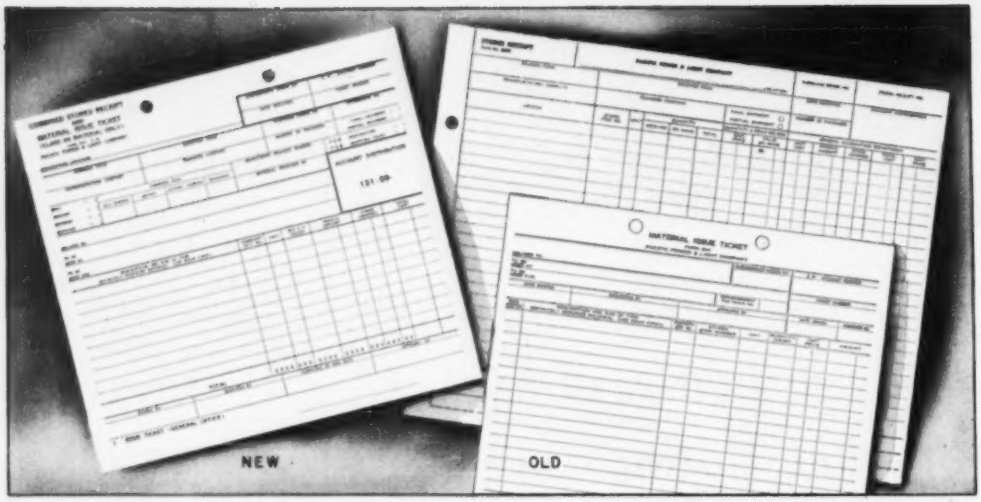
New surge-tank development

High-current arcs manifest themselves as shock waves inside the tank. To reduce the impact on the bottom of the tank and the foundations, and to eliminate rebound, surge tanks are mounted in the breaker to absorb the shock. Here again, Westinghouse engineering development and testing make higher ratings possible.

Chronology of breaker developments

In 1930, the original "De-ion®" grid reduced breaker opening time from 30 cycles down to a new standard of 8 cycles. The Multi-flow grid in 1940 made higher ratings possible and reduced standard opening time to 5 cycles. The extension of the Multi-flow grid principle has resulted in smaller sizes, lower oil content and higher interrupting ratings, and faster opening times down to 3 cycles.

To learn how these new developments can help you, call your Westinghouse Electric Utility representative . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



SINGLE FORM permits a record to be kept of materials and equipment purchased for specific construction job with less clerical work and less detail posting. New form replaces two forms previously used. Old forms were designed for accounting of regular stores items

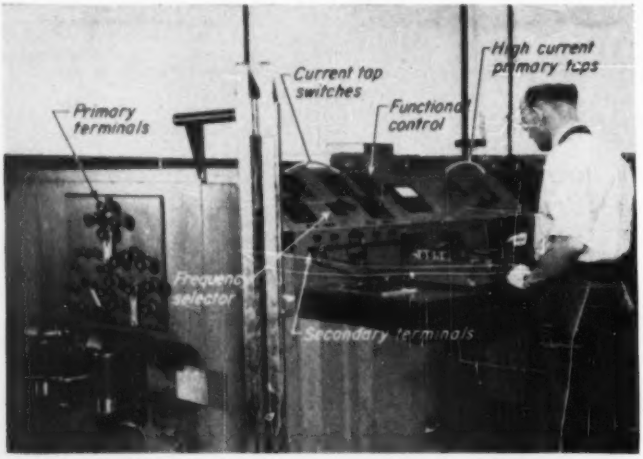
Single Form Provides Accounting Short-Cut

A single form to account for materials or equipment purchased for specific construction jobs provides Pacific Power & Light Co with a short-cut method of handling a specialized materials accounting problem. Made out in six copies using one-time carbons, the single form replaces two other forms previously used by the company for this purpose. The two forms were designed for use in accounting for regular stores items.

Materials for which the new form is devised normally remain in original packages until they are needed on the specific job. Under present conditions considerable time may elapse between receipt and use. Using the new form, receipt is registered properly. By retaining the right number of copies until date of actual use, charge-out is done without additional clerical work. Detail posting to stores accounts also is reduced.

The new method was devised by George F. Collison of the company's general stores section.

Test Cubicle Replaces 33 Separate Standards



CURRENT TRANSFORMER TEST CUBICLE is built around four standards with multiple-tapped primary and secondary windings. Switches on dead-front panel and two terminal boards permit tests to be run on transformers which formerly required 33 portable standards

N. B. PHILLIPS, Supt of Meters and Tests, Niagara Mohawk Power Corp, Buffalo, N. Y.

More efficient operation and less chance for error are features of a current transformer test cubicle designed and built by Niagara Mohawk Power Corp. The cubicle provides one piece of equipment that does the work of 33 separate portable standards used previously. It has eliminated labor involved in handling of the separate standards and has released for other use storage space required for the standards.

Test cubicle is built around four standards with multiple tapped primary and secondary windings. The secondary windings are split to allow testing at the highest current range. Studs for changing primary taps are on the side board of the cubicle. Connections for making secondary taps

ALLIS-CHALMERS
INSTRUMENT
TRANSFORMERS

Outdoor current transformer for heavy duty metering, Type KO. Ratings up to 15 kv and 800 amperes.

Outdoor potential transformer, 200 va, Type PWD. Ratings up to 15 kv.

Indoor potential transformer, 200 va, fused or unfused, Type PD. Ratings up to 14,400 volts.

Safety Factor *stepped up!*

BECAUSE OF THIS VACUUM-PRESSURE PROCESS

THE SPECIAL CHAMBER shown above houses a modern vacuum-pressure system for compound-filling Allis-Chalmers instrument transformers. Here the core-and-coil assemblies and compound become a compact unit—with all parts positively positioned for life. And because air and moisture are kept out permanently, insulation strength is retained almost indefinitely.

Here's How It Works

When the door is closed on the core and coil assemblies (preheated before they are placed inside), a combination of high vacuum and Sahara-like heat whisks away all moisture and entrapped air. Soon the assembly is bone dry. Then hot liquid compound—from which air and moisture are removed—is directed into the transformer case. When case is full, vacuum is released. The hot compound is forced into the innermost recesses of the tanked assembly, completely filling all voids. The transformer is then removed to another area for cooling and final finishing.

You Get 4 Big Benefits

The Allis-Chalmers method of compound-impregnating results in a higher safety factor for your instrument transformer . . . giving you these four advantages:

1. High dielectric strength
2. Air and moisture cannot attack insulation
3. Eliminates maintenance of an insulating medium
4. No leakage or contamination

The extra benefits resulting from this compound-impregnating process can save you money. Why not contact your nearby Allis-Chalmers district office today for more information. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A 3742

ALLIS-CHALMERS

VICTOR DISTRIBUTION INSULATORS

NOW EVEN BETTER WITH

PURIFIED PORCELAIN!

Spools, guy strains, pintypes, suspensions—all are made of the same new *PURIFIED* PORCELAIN as VICTOR's high voltage transmission types. This means that every VICTOR insulator is a better insulator—with highest insulation values, unequalled density, rock-like strength, hardness and resistance to impact, and a product uniformity never before achieved!

Through years of research, VICTOR has eliminated the last big variable in porcelain-making by removing all mineral salts from water used in processing. Results are reduced fluctuations in shrinkage and density and virtual elimination of microscopic, glass-like impurities which, up to now, have prevented maximum insulator strength and hardness. Remember—VICTOR *PURIFIED* PORCELAIN is the finest insulator porcelain ever made!

VICTOR INSULATORS, INC.
VICTOR, N. Y.

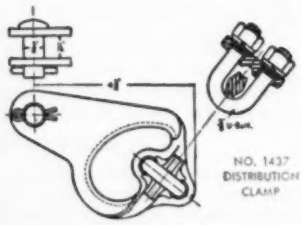
NO. 5 LOW-VOLTAGE PINTYPE

NO. 504 GUY STRAIN

NO. 2012 SPOOL

NO. 804 SUSPENSION

Specify **VICTOR INSULATORS**



NO. 1437 DISTRIBUTION CLAMP

DISTRIBUTION LINE HARDWARE

VICTOR carries a complete line of distribution clamps in all required types and materials to accommodate cable sizes from 0.145 to 0.60 inches. Snubbing, quadrant or boltless types in forged steel, malleable iron or pressed steel with or without aluminum liners, according to type and size of cable to be accommodated.

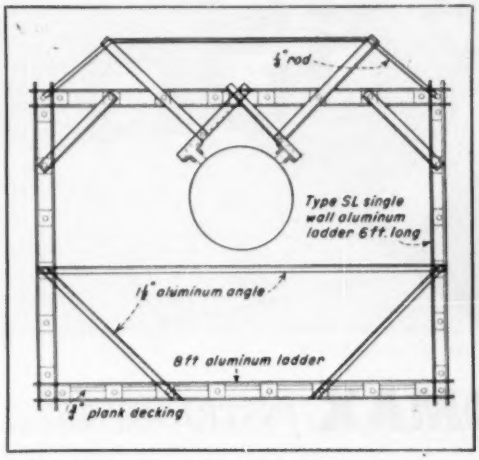
are on the dead-front panel board.

Switches on the panel board include a 25 or 60-cycle frequency selector; four current selectors which provide these ranges: 5-50 amp; 60-250 amp; 300-800 amp; and 1,000-6,000 amp; high amperage primary tap selectors; fine control and course control selectors; and a functional selector.

This last switch allows the operator to test the current transformer with the built-in burden; to cut over to a substitute burden; or to use an external burden when testing current transformers used in special relay applications. The functional selector also permits the operator to demagnetize or run overload test on the transformer.

Test cubicle permits phase angle and ratio error of all current transformers to be measured for 5%, 10%, 25%, 50% and 100% of rated load in terms of the secondary current.

To make a test, the operator places the current transformer in a pneumatically operated clamp, which replaces special bolt-down C-clamps. Jaws of the new clamp can be adjusted horizontally to accommodate all current transformers rated up to 1,200 amp, 34 kv. Current transformers rated above 1,200 amp are tested on a bolt-down, adjustable rack on the back panel.



PIPE LINE painting is speeded by this dolly made from three aluminum ladders and aluminum angles. Small casters riding on top of hydrostation pipeline support painting dolly

MODIFIED DOLLY has large sheaves for supporting from wire. The author, right, designed dolly. M. R. Whitaker (center) supervised job. Line foreman, C. E. McFalls, is at left.

Dual-Purpose Aluminum Dolly for Line Repair

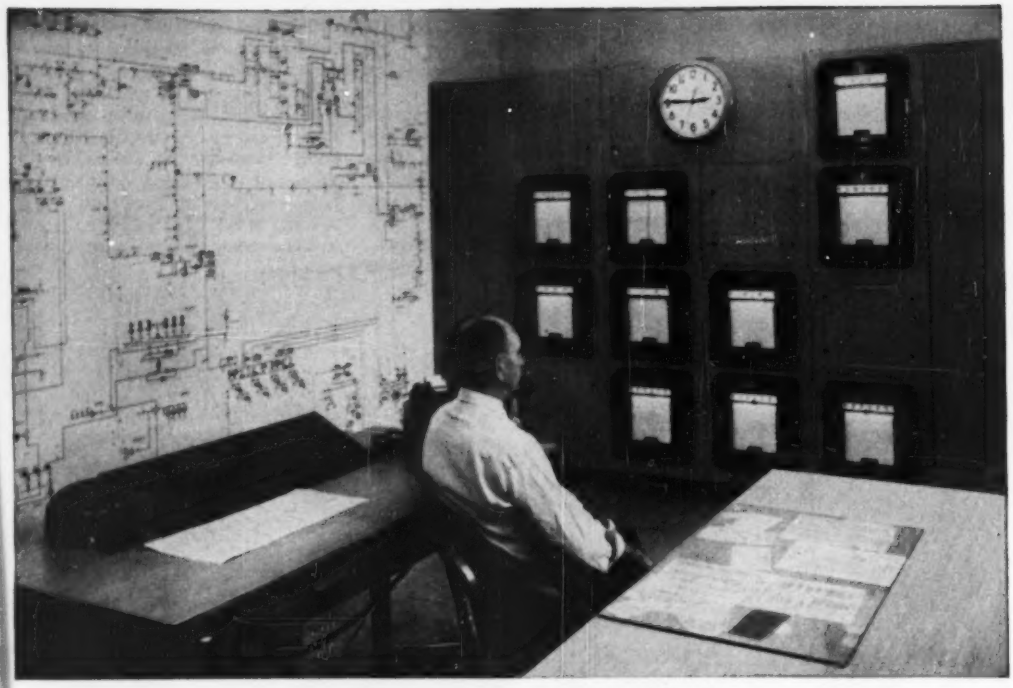
H. H. GNUSE, JR., Vice President, Nantahala Power & Light Co, Franklin, N. C.

This dolly designed for painting the Queens Creek hydrostation pipe line, saved 266 man-hours when used for a transmission line repair job.

The previous estimate for this transmission line repair job, made on the basis of lowering the wire and applying repair sleeves would have required 15 hours for 11 men. In addition, two days' time of ten men would have been required to reclear the right-of-way in the gorge and to haul the compressor and sleeves into place—making a total of 325 man-hours. This dolly enabled the repair job to be completed in 49 man-hours; plus another 10 man-hours required to modify the dolly for use on the transmission line.

The span which was repaired is 2,300 ft long with a normal sag of approximately 140 ft. At mid-span, ground clearance is 290 ft. The repair job was necessary because of breakage of strands in the outer layer of the 397,000 CM ACSR from blasting during construction of the Queens Creek pipe line and from burns from an overhead static wire which fell across this span. At first, it was thought that there were only three or four damaged places on the cable; however, on close examination from the dolly it was found that there were seven damaged spots which required sleeves. Standard compression repair sleeves were used, but instead of using the heavy hydraulic compressor for pressing these sleeves, the jaws of a large bolt cutter were ground out to the proper size so that the sleeves could be compressed with this cutter.

The pipe which was painted had an outside diameter of 2 ft. It was supported on steel bents of various lengths ranging up to 50 ft in height with clear spans of 64 ft. The dolly was pulled from support to support by means of rope blocks and was passed over the supports by removing three bolts and allowing the bottom to swing down so that it would clear the supports. A normal complement on this dolly would be three men—one sitting on top painting the top of the pipe and one on each side painting the bottom and sides as it was moved along. All painting was performed with spray guns. This pipe line has a total length of approximately 5200 ft, but only about 3500 ft were painted with this dolly since the remaining portion was low enough to be painted from the ground.



HERE'S WHY **SPEEDOMAX** *INSTRUMENTS do a better load-telemetering job*

Today's growth of system load and system capacity places even greater premium on speed and accuracy of load dispatching. Quality of the dispatching job, however, depends to a considerable extent on the means used for telemetering load facts from all parts of the system to the system operator's office. Here are some of the reasons why major power systems have selected Speedomax Telemeters to do their data-gathering work:

DESIGN FEATURES

Response: Choice of impulse or continuous types, depending on speed required for the application.

Accuracy: Reproduction of measurements is so faithful that transmitter and receiver charts are practically identical.

Self Synchronizing: Transmitter and receiver automatically stay in step—can even operate from power sources at different frequencies.

Simplified Testing: Built-in checking facilities permit test and calibration of channel without meter tests.

OPERATIONAL FEATURES

Transmission Distance: Works with telephone, microwave or carrier channel, over any distance the channel can span.

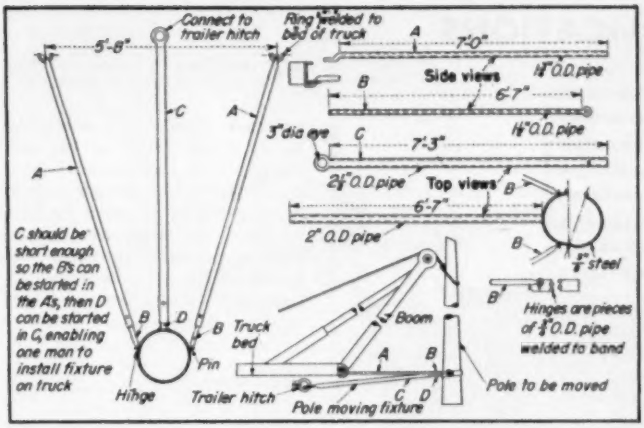
Retransmitting and Totalizing: Speedomax can be supplied to retransmit, to integrate, to add up area generation, net interchange, etc.

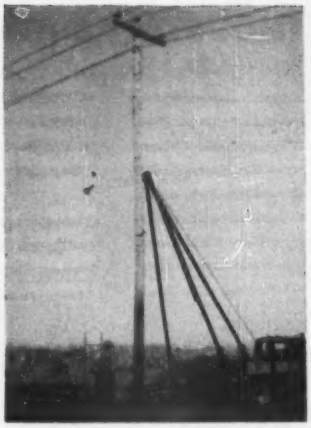
Automatic Control: Speedomax Telemeters work directly with L&N Load-Frequency Control, and are engineered as an integral part of system control.

For details, write to Leeds & Northrup Co., 4938 Stenton Ave., Philadelphia 44, Pa.

LEEDS NORTHRUP

Jrl. Ad ND46-58-461(4)





Line Truck Fixture Cuts Pole Moving Costs

VERNE WILLIAMS, Iowa Southern Utilities Co

Special pole moving equipment has been designed to cut the cost of moving lines for highway widening projects. Its use permits lines to be moved "hot" for distances of 20 to 25 ft, depending upon span length, sag, and other conditions. The device was built of pipe and strap iron in the Company's own shops. A mechanic welded it together with an electric welder. This fixture grips butt of pole and holds pole in vertical position as it is moved to new location. Two men using a small portable digging machine and a truck equipped with this fixture can move several miles of ordinary rural line in a day. Transmission line poles up to 40 ft in length have been handled. When costs were compared to previous method of setting a new pole line and transferring conductors, savings were substantial.

Additions Extend Use of Aerial Ladder Truck

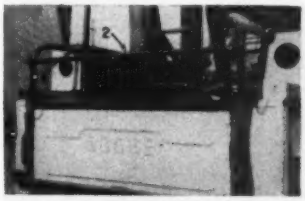
HAROLD SEITZ, District Serviceman, The Ohio Power Co, Ottawa, Ohio

Three additions have been made on aerial-ladder trucks so they can be utilized not only for replacement of overhead street lights but also running customers' services, installing cable, and general service work. The additions are (1) a tilting rack for a straight ladder; (2) a removable rear railing; and (3) a convenient rear button and cab buzzer for signalling the driver.

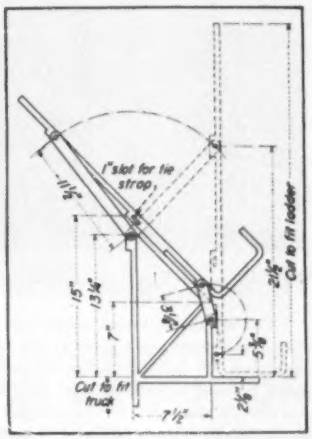
The straight-ladder rack is mounted above the right-side tool compartment so it does not obstruct use of the aerial ladder, movement of men on the truck bed, or access to the cab door. When the truck is parked for use of the aerial ladder, and convenient movement of men, the straight-ladder rack is tilted into the vertical position so it is out of the way but readily accessible to men on the ground for convenient removal or storing. During transit it is tilted into the inclined position and the straps tightened to prevent ladder vibration.

The removable rear railing, which slides into sockets on the side hand rails, consists of a 1-in. conduit. It is mounted high enough to prevent anyone on the rear truck bed being thrown out if the truck should be started unexpectedly. Pins hold the railing in the sockets. When not in use the bar is carried in brackets welded to the aerial-ladder rack just behind the cab.

The push button for signalling the driver is installed in the under side of the left hand rail adjacent to tool bin.

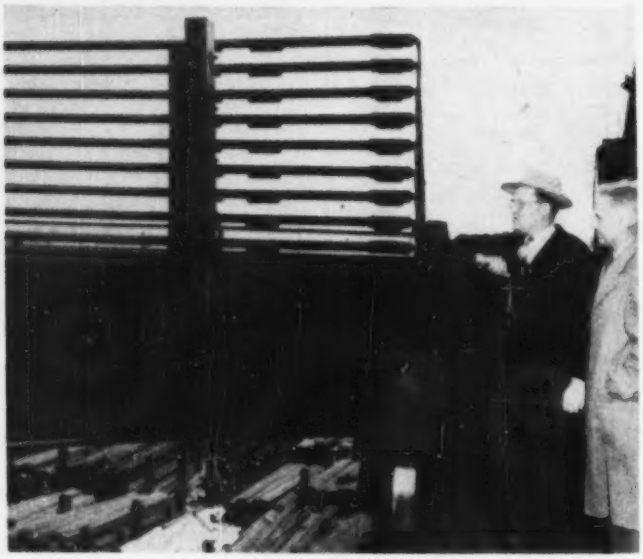


STRAIGHT LADDER RACK has been added to aerial ladder truck for extended use. Other additions are: Socket and pin (1) for holding rear safety bar (2) and signal button (3) for driver



TILTING LADDER RACK is shown in inclined position. Frame and rack are ½ x 1¼ in. channel iron. Links are 3/16 x 1 in. strap iron. Holes are ½ in. with ⅜ x ½ in bushings for ⅜-in. bolts

INDUSTRIAL APPLICATIONS



TROLLEY PIPES for storage yard crane are kept free of ice during sub-freezing weather by electric heat from lead-covered heating cable. Formerly ice was chipped off conductors causing marring of surfaces which produced burning between shoe and wire. W. Harding (left), plant engineering, Ford Motor Co, and R. H. Masters (right), Industrial Power Engineer, Ohio Power Co. Total connected heating cable load is 12 kw.

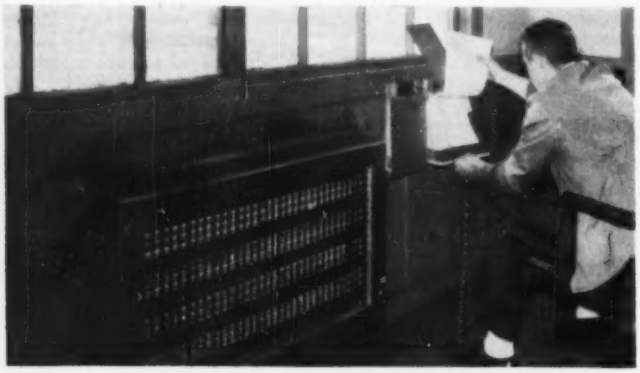
Heating Cable de-Ices Crane Rails

R. H. MASTERS, Industrial Power Engineer, The Ohio Power Co, Canton, Ohio

Electric heating cable has solved the trolley icing and commutation problems of two 100-ft bridge-type cranes at the Forge Plant of the Ford Motor Co, Canton, Ohio. Ice formation on trolley rails and marring of trolley conductor surfaces have been eliminated. Commutation on the main bridge rails has also improved due to small current flow through collector shoes established in feeding the heating cable. The trolley pipe now remains smooth and elimination of costly maintenance and uninterrupted operation of the cranes have saved many times cost of installation.

One crane formerly used 2-in. angle-iron as a trolley rail and the other crane used No. 4 solid copper wire. There are 10 rails per crane, and the problem was to apply electric heat to the rails to prevent this icing. Several methods were considered and a final decision was made to replace the angle-iron and copper wire rails with 1¼-in. black iron piping which encloses lead-covered heating cable fed from the 250-v dc service on the crane. Total length of the trolley pipe is 2000 ft and 4000 ft of cable is utilized, resulting in 600 w per rail or a total connected load of 12 kw.

The ice formation on the formerly used trolley rails was further aggravated by the condensate from the exhaust of a number of steam hammers, which added to the trouble when the air humidity approached the saturation point.



Heaters Solve Office Comfort Problem

Office heating for several out-of-way offices at H. H. Robertson Co, Ambridge, Pa., using electric air heaters, provides low first cost, clean and safe heat regardless of outside weather conditions. Long pipe lines required by other types of heating systems considered are eliminated. Each office heater has five 1000-w strip heaters, designed and assembled by Robertson engineers. E. M. Wenner, Industrial Power Engineer, Duquesne Light Co, Pittsburgh, Pa.

Plug-In Fluorescent Light Saves Rewiring Costs

Flexible lighting arrangement and reduced branch circuit rewiring costs are accomplished by plugging-in fluorescent lighting fixtures into duplex 3-wire receptacles in existing ceiling outlets in the electrical modernization of the Materials and Test Laboratory of the Texas Highway Dept, located at Camp Hubbard, Austin, Texas.

By supporting fixtures from rods extending through composition board ceiling to 2 x 4's resting on attic floor joists, they can be easily relocated when laboratory arrangements are changed.

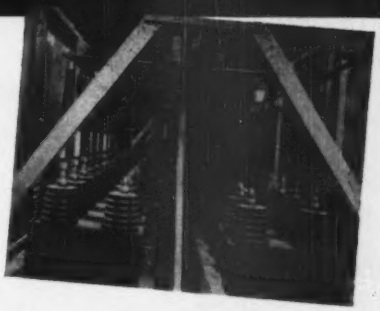
These fixtures are grounded by third wire of plug-in cord to third terminal of 3-wire receptacles and then to the associated outlet box. Wm. G. Darley, Consulting Engineer, Austin, Texas.

99.5%

BONNEVILLE reports:

TROUBLE-FREE SERVICE FROM IT'S C-D CAPACITORS

Bonneville Power Administration reports that its C-D capacitors have so far delivered over 1,100,000,000 Kvar hours of 99.5% trouble-free service — an unmatched field performance record!



a typical time-tested C-D installation

C-D 18,790 Kvar sub-station, part of 20,160 Kvar purchased for Longview in 1942.

A C-D engineer will be glad to point out the many dollar-saving characteristics of C-D capacitors.

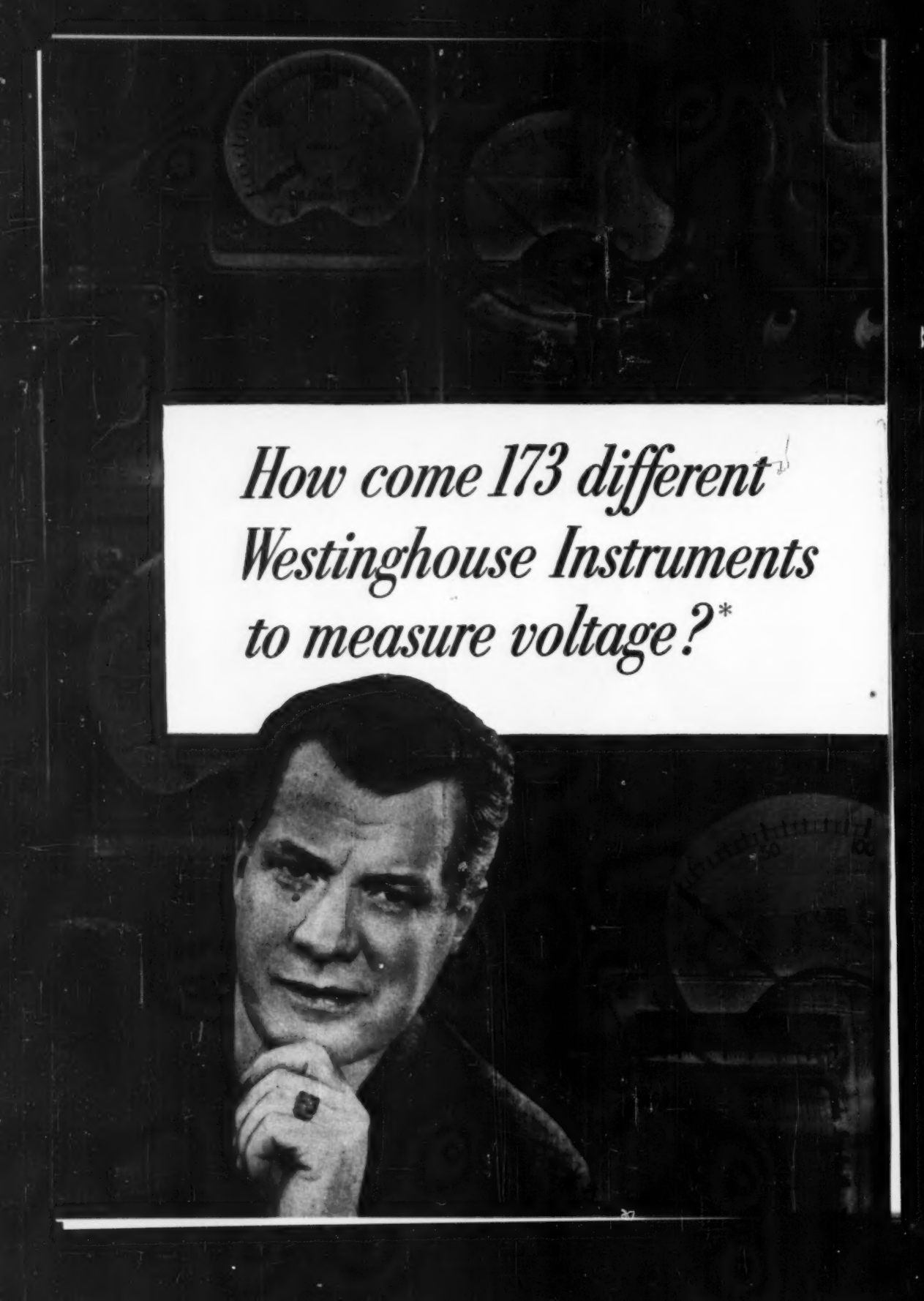
CORNELL-DUBILIER ELECTRIC CORP.
DEPARTMENT D-630
SOUTH PLAINFIELD, N. J.

1910 1952

CONSISTENTLY DEPENDABLE

CORNELL-DUBILIER CAPACITORS

PLANTS IN: SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER, CAMBRIDGE, MASS.; PROVIDENCE, R. I.; INDIANAPOLIS, IND.; FUQUAY SPRINGS, N. C. AND SUBSIDIARY: THE RADIART CORP., CLEVELAND, OHIO


How come 173 different
Westinghouse Instruments
to measure voltage?*

Because

—a wider choice of instruments offers you . . . greater latitude in product design . . . the answer to more precise control of a process . . . an opportunity to boost the efficiency of plant facilities.

the proper instrument

Whether you want to measure amperes, volts, watts, vars, frequency, power factor or synchronism—you can always get the *right* instrument when you specify Westinghouse. It's the most complete line of electrical measuring instruments in the industry! The line also includes many types to measure position, time, temperature and speed.

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For any instrument application, you want sustained accuracy . . . easy readability. Westinghouse designs are the result of over 60 years of instrument engineering aimed at giving you the ultimate in these essentials of fine instrumentation. The performance of all Westinghouse Instruments meets ASA Standards.

properly applied

You save engineering time and expense . . . gain more effective use of instruments when you have manufacturer's assistance in their application. A team of highly trained Instrument Application Engineers is available to work with you in applying all Westinghouse Instruments.

registers an advantage for you!

The experience of a large eastern manufacturer provides an example. By applying standard Westinghouse GY-40 Recording Wattmeters to predetermine load on mixers, they obtained a 15 percent saving in mixing cycle time! A typical pay-off when the proper instrument, properly engineered is properly applied! Next time, specify Westinghouse! J-40418

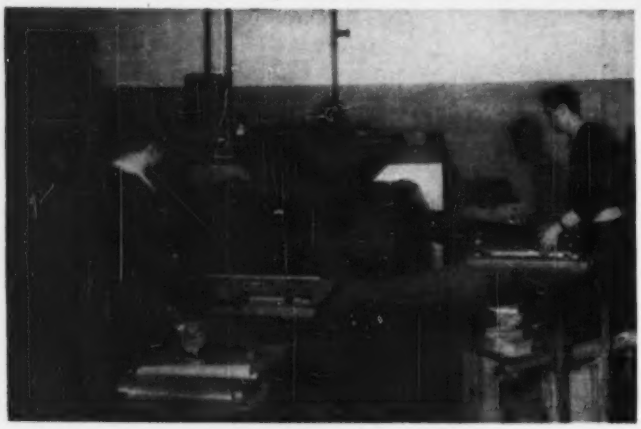
*

The extensive coverage of Westinghouse voltage measuring instruments is further emphasized by the fact that there are 36 different instruments just to measure d-c millivolts.

For complete information about all Westinghouse Instruments, wire for Booklet B-4696. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE... IF IT'S

Westinghouse



WOOD PANELS for TV and radio cabinets are glued in a matter of seconds with r-f unit and 10-kw generator. Conveyor aids three operators complete cycle in less than 1 min

R-F Heat Cuts Glue Drying Time

L. **ALBERTSON**, Application Engineer, Philadelphia Electric Co

Glue drying on TV and radio cabinet wood panels by dielectric heat at the Harry A. Prock Co, Glenside, Pa., cuts drying time to seconds. Combination r-f unit with 10-kw generator and a circular conveyor enables complete cycle of forming assemblies on conveyor, applying heat, and removing finished section to be accomplished in less than one minute. Three operators place wood forms in a series of jigs on a circular conveyor instead of loading and unloading layup tables. Previously, glued sections were placed in clamps and set by atmospheric drying. Firm recently installed second unit.

Automatic Welding Speeds Production

Automatic welding of "Q" panel spacers with two 160-kva, 3-phase welders at H. H. Robertson Co, Ambridge, Pa., speeds production, keeps power factor high and power demand to a minimum. Greater welding capacity is obtained from power facilities. Skilled operators are not necessary. After welding cycle is established to meet requirements of type metal fabricated (stainless steel, aluminum, galvanized steel, or black steel) welding of panel parts is entirely automatic. Operator merely presses foot pedal to start welding. E. M. Wenner, Industrial Power Engineer, Duquesne Light Co, Pittsburgh, Pa.

INDUSTRIAL BRIEFS

Meat protection by ultraviolet lamps at Julius Stein Co, Philadelphia, Pa. promotes sanitary conditions, and minimizes trimming after aging and storage. Cuts of meats prepared for market and refrigerated only for short periods of time also have quality and appearance protected with the ultraviolet. Storage atmosphere is kept fresh and pleasant. Lamps are rated 18 w each and have a rated life of 12,000 hr. L. Albertson, Application Engineer, Market Studies and Service Division, Philadelphia Electric Co.

Lubricant removal from pre-assembled gear assemblies was solved by electric immersion units at the Ohio Axle and Gear Division of the Timken-Detroit Axle Company, Newark, Ohio. This eliminated major assembly problems. Removal of lubricant was necessary before further assembly operations could be conducted. Electrically heated S.A.E. No. 10 oil in which gear assemblies were submerged caused lubricant to flow freely from gears. Heating was accomplished in tank having two 3-kw, 440-v immersion heaters with thermostat control limiting oil temperature to below flash point. D. E. Dome, Commercial-Industrial Dept, Ohio Power Co, Newark, O.

Ceramic paste firing production is increased and labor required decreased by a new 80-kw electric furnace at the Plastic Assembled Products Co, Baltimore, Md. Furnace uses radiant energy as well as convected heat to rapidly fire ceramic paste used for graduation markings on glass pipettes. R. C. Young, Ind. Eng. Rep., Consolidated Gas Electric Light & Power Co.

Motor drives in Wackerbarth Box Shop's sawmill (Granville, Mass.) are individual, eliminating belting and shafting, while increasing cleanliness and operating safety. Quality of work done is greatly improved with uniform thickness of lumber speeding up planing process. Waste is cut 20% and only one pass of the log is required. A multi-bladed sash mill unit handles up to 25,000 bd-ft daily against 15,000 when using a conventional circular sawmill. Unit is driven at constant speed by 75-hp, 3-ph induction motor. Western Massachusetts Electric powers the mill.

As we begin our second half century...

Today...

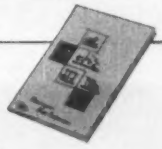
and Then

Your physical properties are your mechanics of existence and their correct design is extremely important. Yet, important as they are, they depend for their very life—and, certainly their profit—on an inner structure, invisible but vital, and that is the company's financial, operating and management structure. The entire field of engineering and management is Pioneer's area of operation to assist you in profitable management.

As an associate of such pioneers as Thomas Edison and George Westinghouse, Henry Byllesby founded Pioneer's earliest predecessor a half century ago. Since then we have grown with Industrial America and, we think, made our own contribution to this era. We understand the aims of business, and over the years we have developed the techniques for realizing them.

Our resources and facilities are indicated here. They are proving valuable to companies of many types and sizes, and may prove equally valuable to you. Use one or a combination of Pioneer's services, for Pioneer is like a variable gear, working smoothly within itself and meshing smoothly with yours.

. . . Alert to overlook nothing which may prove useful, you will want our booklet "Pioneering New Horizons," we feel sure.



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- Insurance, Rate, Accounting and Tax Advisory Service . . .
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Pioneer Service & Engineering Co.

231 South La Salle Street · Chicago 4, Illinois

GRANDMA takes a rocking chair nap and dreams herself into a modern electrical kitchen while the movie camera watches

Westinghouse Offers New Electrical Living Film

"Once upon a time," living like a king was strictly reserved for kings only. But in the film "Better Than Kings," Joe and Mary Ann are monarchs of their household as they have all the electrical "slaves" required for kingly living. This in essence is the theme of a 28-minute full-color movie aimed at builders and home owners to induce them to make their homes "Electrical Living Homes" . . . homes equipped with electrical products that make for carefree and easier living in this modern day.

Impatient with modern gadgets, Joe wishes he were back in the good old days of grandma's time. The story takes him back and he sees that the old days were not so good. Grandma then comes out of the past into a modern electrical home and her joy with modern gadgets is something to behold. They baffle her at first but it doesn't take her long to penetrate their mysteries.

Suitable for showing to social and service clubs, professional groups, home economics students, and many others, the film is available on a loan or outright purchase basis. For information write Better Homes Bureau, Westinghouse Electric Corp, 401 Liberty Ave, Box 868, Pittsburgh 30, Pa.

Clubwomen Visit Universal

Over one hundred members of the Connecticut Federation of Woman's Club's visited Landers, Frary & Clark recently in the first of a series of tours of Connecticut industry. Here, a group of clubwomen learn about the manufacture of Universal irons.

Appliance Sales Pick Up

General Electric Co reports a continually improving retail sales picture for its major appliances. Clarence H. Linder, general manager of GE's major appliance division, said that unit retail sales of the company's appliances during May were up about 24 percent from April and were about 25 percent higher than in May of last year.

Retail sales of the line as a whole, which had lagged badly during the early part of the year, picked up so that sales for the five months ended May 31 were only about 8 percent behind those for the same period of 1951. He reported that the improved retail sales already are reflected in GE distributor sales to dealers and in the company's sales of its principal products to its distributors over the country. Possibly this is the beginning of a welcome trend.

Mailing Piece Once a Week Helps to Sell Rural Market

ROBERT L. COE, Residential Sales Manager, Union Electric Co, St. Louis

Union Electric Company has spent millions of dollars since the war in extending electric service throughout its service area. More than 95% of all potential customers have service today.

Extensive sales promotional activities have been carried on through cooking schools, electrical living shows, contests and similar functions. In spite of this, the number of L.P. gas installations has continued to increase. business has been good for the electrical dealer and few have found it desirable or necessary to make a door to door solicitation in rural territories to sell electrical appliances. But the L.P. gas dealer has been busy . . . he created his bonanza . . . it didn't just happen by accident as some salesmen seem to think.

In the belief that if people knew the facts about electric cooking and electric water heating they would "go-all-electric" a series of ten mailings has been planned to present those facts.

Services of our rate engineers have been enlisted. They were asked "how cheaply would you have to buy bottled L.P. gas in order to cook or heat water at a cost lower than the cost of doing the same job electrically at our rates?"

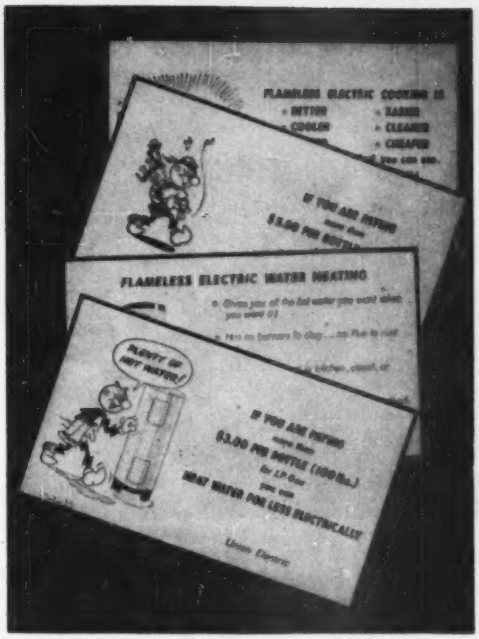
Their studies determined that if customers were paying more than $5 per bottle, 100 lb, for L.P. gas they could cook for less electrically. Furthermore, if they were paying more than $3 per bottle, 100 lb, for L.P. gas they could heat water for less electrically.

A series of mailings is being sent out, one a week, to bring these facts to the customer in a manner they will not forget. Mailings actually consist of only four pieces. Two will be mailed twice each and the other two will be mailed three times each.

The first piece deals with the cost of cooking electrically in comparison to bottled gas. This mailing will be repeated on the fifth and ninth weeks.

The second piece relates the cost of heating water with bottled gas as compared to electricity. This mailing will be repeated in the sixth and tenth weeks.

The third piece describes the advantages of electric water heating and it will be repeated in the seventh week.



SUPERIORITY OF ELECTRICITY is told in four mailing pieces which are repeated in a sequence to give a total of 10 mailings

The fourth mailing sets forth the advantages of cooking electrically. It will be repeated in the eighth week.

Electrical distributors have been invited to prepare pieces to follow the company's mailings to these customers, listing the advantages of their brands of merchandise.

It is too early to forecast the results that we will achieve as a result of these mailings but they have had a stimulating effect upon the dealers and distributors throughout the area.

These mailings should bring to the people in the area an understanding of the advantages of cooking and heating water electrically . . . and the comparative cost thereof. If the facts are known it is believed that customers will Go All-Electric.

Tobacco Sorting Aided By Lamps, Humidifiers

J. E. COLLINS, Appalachian Electric Power Co, Abingdon, Virginia

Fluorescent lamps, an electric dehumidifier, and fans enabled C. H. Spahr and H. H. Hendricks of Washington County, Va., to get started in a profitable new business last fall—sorting and grading burley tobacco in preparation for market. Under the fluorescent lighting, the processing could be carried on 24 hours per day during rush periods. A total of 88,766 lbs of tobacco in 53 crops was handled by 38 workers at a wage cost of $5,184.67.

Tobacco brought into the sorting building was tied in bundles like corn fodder. If it was too dry it was moistened on a steam table or on racks; if too wet it was placed in a drying room equipped with a de-humidifier and circulating fans. Ready for processing, the tobacco went to a sorting unit, consisting of three sorters and a tier working under a fluorescent fixture with two 40-watt lamps.

Off-Peak Water Heating for Commercial Users

As part of a program to market surplus off-peak power, Seattle City Light plans an intensive campaign to sell owners of hotels and apartment houses on the merits of heating water by electricity in the spring and summer. Tests have determined the economic feasibility of operating large-volume electric water heaters in commercial installations, said P. C. Spowart, assistant superintendent in charge of sales work.

NEW EQUIPMENT

Six-Foot Street Light

A six-foot fluorescent street light, reportedly "the latest development in modern street lighting" is a recent addition to the respective field of lighting.

The new six-foot long fluorescent fixture is stated to provide a constant source of virtually glareless light despite outdoor temperature changes which normally decrease the efficiency of fluorescent lights. A recently developed fluorescent lamp enables the new fixture to reach this high operating level.

Designated the Form 206, the new street light contains four, 100-w "rapid start" fluorescent lamps. Light is reflected through a large, clear, plastic housing. The entire fixture weighs about 100 lb and, unlike other fluorescent street lights, houses its ballast (transformer) making it a compact unit.

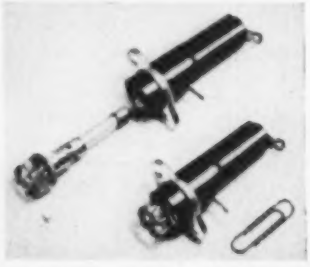
Maintenance-wise, the new street light has its plastic casing hinged to its aluminum hood, permitting rapid lamp replacement.

General Electric Co, Schenectady 5, N. Y.

Indicating Fuseholders

A new addition to panel-mounting fuseholders has been announced recently. Called the Fuselite, it takes a standard 3 AG or 3 AB fuse. A unique feature is the integrally molded neon bulb in a crystal clear plastic lens that lights up instantly when the fuse blows. This aids locating the trouble quickly.

The type 440-5FH has practically universal application in 110-v circuits.



Assembly into equipment is said to be quick and easy. Tabs are provided to allow for quick connections and fast soldering.

Alden Products Co, 117 North Main St, Brockton, Mass.

Radar Type Fault Locator

Called the Metrofault, this new electronic instrument uses the radar or pulse reflection technique for locating faults on power or telephone lines.

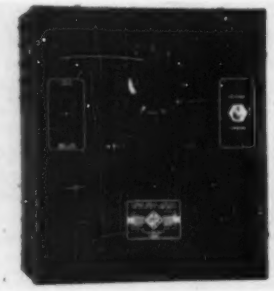
Open wire lines in ranges of 10, 30, 100, and 300 miles, or 12 miles in cables of either type may be tested. A unique feature, it reportedly is able to locate open circuits as well as shorts and grounds. The instrument consists of a transmitter, protective apparatus, a receiver, cathode ray tube, and a calibrated sweep and ranging circuits.

Distances are measured by means of a controlled deflection in the sweep, called a step. The dial reading of the distance to the fault in miles is said to provide an accuracy better than 0.5% of the scale used.

Metrotype Corp, Chicago 20, Ill.

Motor Speed Control

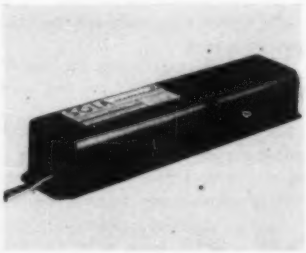
A ¾-hp Variac motor speed control has been designed for light production work where a ¾-hp motor is used. This control uses no electronic tubes and so takes no warm-up time. Instant starting and reversing are provided along with dynamic braking.



The compound wound motor used with the speed control has much better starting characteristics than the usual induction motor. Starting time is less and heat up is less under repeated starts, stops or reversals.

Designated Type 1702A, the equipment provides adjustable-speed operation of dc motors from ac power lines.

General Radio Co, 275 Massachusetts Ave, Cambridge 39, Mass.



Lamp Ballast

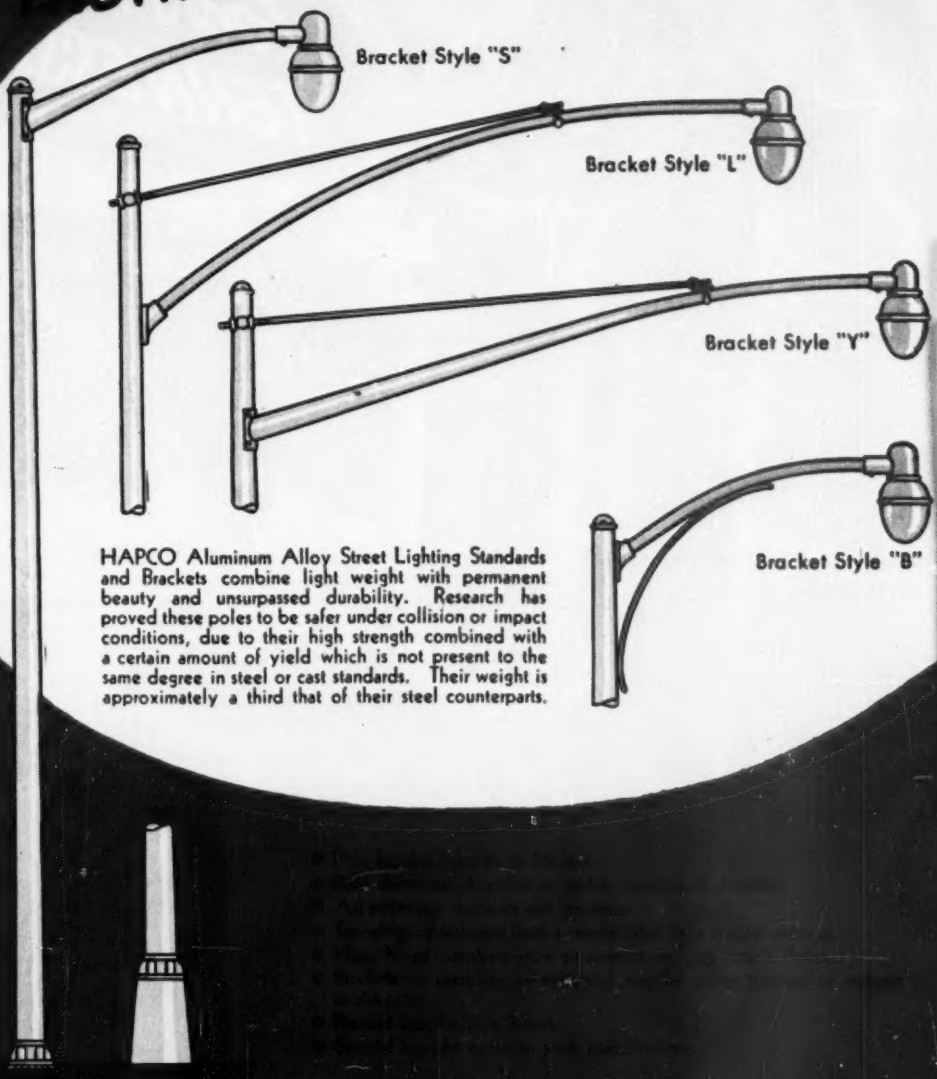
The new Sequenstart fluorescent ballast for two 96T12 fluorescent lamps has been developed. The new unit is a series-sequence type ballast.

This ballast is stated to afford an increased lamp starting current to assure full rated lamp life.

The ballast is said to retain and improve on the advantages of conventional lag-lead ballasts. It is reportedly cooler, quieter, lighter, smaller, more efficient and less expensive than lag-lead ballasts.

Sola Electric Co, Chicago 50, Ill.

for LIGHTING BEAUTY



HAPCO Aluminum Alloy Street Lighting Standards and Brackets combine light weight with permanent beauty and unsurpassed durability. Research has proved these poles to be safer under collision or impact conditions, due to their high strength combined with a certain amount of yield which is not present to the same degree in steel or cast standards. Their weight is approximately a third that of their steel counterparts.

Facts from
TENNESSEE

"'CSP'® Transformer saves $125 per year in service calls"

"25 service trips for re-fusing during each lightning season, at a cost of about $5.00 per trip, was the price we had been paying to keep a single conventional transformer in service," reports a Tennessee Utility. "The transformer was located in a particularly severe lightning area, and we had come to accept the outages as somewhat pardonable. One day it was necessary to make three trips to restore service.

"About 10 years ago we replaced it with a 'CSP' transformer which has been in continuous service ever since. Its record of performance, paying for itself within the first year, has resulted in our adoption of 'CSP' transformers for all rural construction."

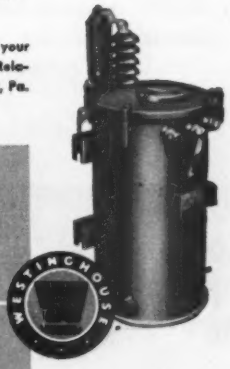
Installation and maintenance costs for Westinghouse "CSP" (Completely Self-Protecting) Transformers are always lower, because complete protective equipment is built in, not separately mounted. A two-year survey of Electric Light and Power Companies shows the following:

NATIONAL AVERAGES

	"CSP"	Conventional
Installation Costs	$13.87	$24.74
Burn-out Rate	0.257%	1.005%
Fuse Outages	None	5.64% @ $6.52 per outage
Load Checks	Automatic	12.8%
Breaker Reset	1.02%	None

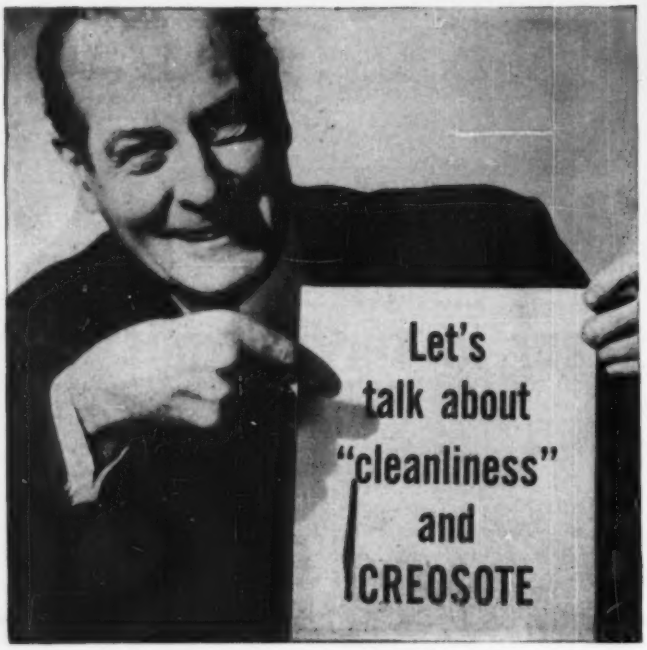
If you'd like to check your own costs against these national averages, ask your Westinghouse representative for Booklet 4247-B, "Transformer Costs and Their Relation to Profits". Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

"CSP" devices . . . originated and patented by Westinghouse



YOU CAN BE SURE... IF IT'S
Westinghouse
"CSP" DISTRIBUTION TRANSFORMERS

J-70393



Today's modern Wood Preserving Plants know how to protect poles with creosote and leave them dry and "clean." Specifications for clean treatment, when combined with proper specifications for the creosote used, provide "complaint-free" poles.

One of the largest producers of pressure-creosoted poles reported to us: "We haven't had a single complaint about the cleanliness of the last million yellow pine poles treated with creosote."

For poles that are *clean*—for poles that *will last*—specify "dry pressure-creosoted poles."

KOPPERS COMPANY, INC., PITTSBURGH 19, PA.
Tar Products Division

You can count on Koppers for Creosote!

KOPPERS
All Standard Specifications
Creosote
The Performance-Proved Wood Preservative

Wire Gun Tacker

A new flat parallel conductor inside telephone wire can now be installed at high speed by means of a gun tacker. Coming in two and three conductor styles with No. 22 gage soft copper conductors, the wire has one tinned conductor for instant polarity identification.

The gun tacker used for installing this wire is specially modified so the staple is installed around the insulation without deforming the wire. The wire can be guided along beams, panels, or baseboards with one hand while the other operates the gun tacker.

Whitney Blake Co, New Haven 14, Conn.

Color Sorting Machine

A new electronic color sorting machine, the Gromax, is designed for the photo-electric color selection of a wide variety of products.

The machine consists of compact sub-assembly, anyone of which can be removed and interchanged with a minimum amount of time. Maintenance can be made during actual production and alternative machines can be serviced by the supervisor while the battery of machines is operating.

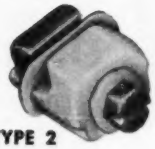
2 WAYS TO MEET YOUR ALUMINUM CONNECTION REQUIREMENTS with FARGO "One-piece...Vise-type" CONNECTORS

1

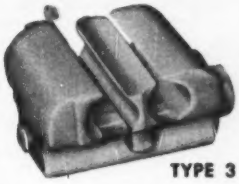
The FARGO "9000" Series for **like-metal** contacts

. . . comes in four types: TYPE 1—for aluminum-to-aluminum—and TYPE 2—for aluminum-to-copper—are for smaller wire sizes, up to and including 4 ACSR. TYPE 3—for aluminum-to-aluminum—and TYPE 4—for aluminum-to-copper—are for larger wire sizes, above 4 ACSR. ALL FOUR TYPES are designed to provide wider contact areas on conductor surfaces, with "like-metal" contacts to minimize galvanic corrosion. They are MASSIVE for better conductivity and greater heat dissipation—and are of "one-piece" construction for ease of handling and installation.

TYPE 1



TYPE 2



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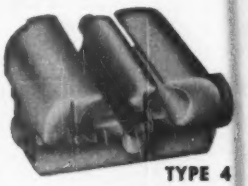
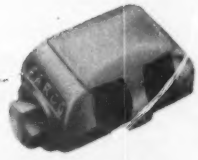


TYPE 4

2

The FARGO "8000" Series Plated for **all-purpose** Connections

. . . utilizes a bronze body and copper spacer. Spacer provides good area of contact between conductors—hence good conductivity . . . low "cold flow". Liberal spacing also minimizes galvanic corrosion of dissimilar conductors. Also, "one-piece" construction—plated for friendly contact with aluminum. Fits wide ranges of conductor sizes—thus reducing the number of connector sizes to be stocked.



. . . "built like a vise — grip like a vise."

Ask your Line Material Field Engineer to give you complete details.

FARGO

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie, N.Y.

Distributed by
LINE MATERIAL COMPANY
(A McGraw Electric Company Division)
Milwaukee, Wisconsin

LM

GET
FAST INSTALLATION
COST-CUTTING ECONOMY
DEPENDABLE PROTECTION
with
BERMICO®
FIBRE CONDUIT

Bermico Fibre Conduit is easy to work and handle. Lightweight 8-foot lengths can be cut and tooled right in the field. Smooth inside bore assures quick "pull throughs" without chafing or abrasion.

Bermico Fibre Conduit holds down costs. Lays in a jiffy. Water-tight couplings go on fast—no sealing compound needed.

Bermico Fibre Conduit is engineered to withstand shocks and stresses of haulage—the heavy loads imposed during installation.

Complete line of bends plus angle couplings enable you to meet unusual field conditions.

Specify BERMICO—*for long service at low cost.*

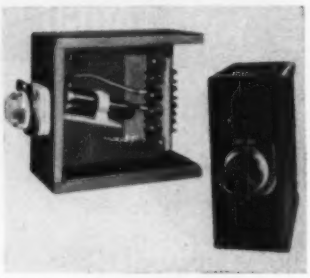
Distributed by
WESTINGHOUSE
Electric Supply Company
Offices in principal cities

BROWN QUALITY COMPANY, Berlin, New Hampshire
CORPORATION, La Tuque, Quebec

SOLKA & CELLATE PULPS • SOLKA-FLOC • NIBROC PAPERS • NIBROC TOWELS • NIBROC KOWTOWLS • BERMICO SEWER PIPE, CONDUIT & CORES • ONCO INSOLES • CHEMICALS

Undesirable units being examined are extracted from the product to a point reaching nearly 100% efficiency. The costly hand labor saved by the machine is said to pay for the machine in a short time.

Newman's Inc, P. O. Box 1865, Tulsa, Oklahoma



Mercury Switch

A new mercury switch for positive safety in hazardous, explosive locations has been developed recently. The heart of the unit is a hermetically sealed mercury switch mounted on a lever-operated armature.

The switch is set in operation by a selector knob or push button which inclines the armature and actuates the mercury switch. Spark danger is eliminated because of an all-mechanical nature of the actuating linkage.

It is designed for vertical panel mounting and is a single pole with either single or double throw action. On all push button models, a spring action is featured which returns the switch to original position when finger pressure is released.

Tigerman Eng. Co, 4332 No. Western Ave, Chicago 26, Ill.

Accounting Machine

A Series 400 accounting machine has been developed that reportedly is providing the fastest and most automatic known methods of billing for Rural Electrification Associations and municipal and privately owned utilities.

Claimed to be the fastest for utility billing, the machine features automatic billing. Writing the normal bill and posting the ledger requires the indexing of only three keyboard amounts and three depressions of the regular motor bar. All other operations are automatic.

Arrears and miscellaneous items can be easily handled by the additional key-

board amount and motor bar operation for each item.

Capital credit rate tables can also be prepared on the machine in a continuous operation.

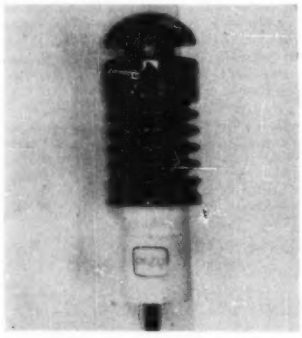
Burroughs Adding Machine Co, Detroit 32, Mich.

Heat and Sun Lamp

A portable table model sun-ray lamp of 500-w capacity has been developed by Philips Lamps of Eindhoven. The lamp emits ultraviolet and heat rays. The heat rays are emitted by a 300-w glow spiral, the ultra-violet by a 200-w high pressure mercury burner of quartz glass. Both are contained in one bulb of a special glass which rejects all rays other than the biologically important ones. The bulb of the parabolic lamp is silvered on the inside, forming an inner reflector and rays can be focussed in all directions.

Transformer Bushing

A redesigned Quick-Grip transformer bushing is reported to allow the lineman to make a primary line connection without the use of tools. The older bushings were made with a



FREE BOOK

HOW RCA 2-WAY RADIO

SAVES TIME · SPEEDS OPERATIONS · "STRETCHES" EQUIPMENT

. . . tells in non-technical language what 2-way radio is and what it does . . . shows how it works. You'll see how management can know at all times what's going on because it has voice contact with roving crews and with men at remote locations.

. . . shows how RCA 2-way radio expedites materials handling, coordinates survey and construction projects, and eliminates aimless driving in tracking down trouble . . . It reports how 2-way radio is used to route cars and trucks, to mobilize repair crews fast, and to prevent disruption to production cycles.

. . . also covers the survey facilities offered by RCA to determine the 2-way radio system that best meets your business needs . . . includes a digest of the FCC rules regulating industrial radio service . . . reveals how to co-operate with industry's frequency allocation committees.

• • •

This brochure is yours for the asking. (*In Canada, write: RCA Victor Limited, Montreal.*)

RCA
2-WAY RADIO FOR INDUSTRY
FOR
OIL AND GAS INDUSTRY · PIPELINES
PUBLIC UTILITIES · TIMBER & LOGGING
MOTION PICTURE COMPANIES · NEWSPAPERS
CONSTRUCTION · MANUFACTURING · MINING
SPEEDY COMMUNICATION WITH ALL MEN AND EQUIPMENT

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Camden, N. J.

Send me a free copy of "2-way Radio for Industry."

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RCA RADIO CORPORATION of AMERICA

NOW you can bend Thin-Wall Conduit profitably

Here's the efficient way to bend 1¼, 1½ and 2" electro-metallic tubing. It's done with Blackhawk's remarkable all-directional "Porto-Power" hydraulic unit.

NEW Controlled-Roll BENDING SHOES create kinkless, wrinkle-free bends matched offsets

There's no crushing. You get 90° bends in just one setting. Rotate-operation permits bending on the bench or floor — in the most convenient position for handling, sighting and measuring pipe.

ONLY Porto-Power gives you these benefits

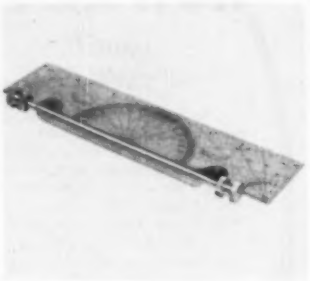
The bending assembly for 1½" conduit weighs only 50 lbs. This means easy handling . . . no wrestling with heavy, clumsy equipment. The equipment pays for itself on the first good job.

Write for free Bulletin No. 50B on Benders for both Rigid and Thin-Wall Conduit . . . plus spectacular HYDRAULIC Knock-Out Punches. See leading wholesalers or write Blackhawk Mfg. Co., Dept. P-4162, Milwaukee 1, Wis.

BLACKHAWK

dielectric entirely of porcelain. The newer bushing has a porcelain body but the knob is made of molded hard rubber. Metal portion is molded into the knob, and has a better shape for gripping, weathers well, and eliminates practically all risk of chipping, cracking or breaking.

Kuhlman Electric Co, Bay City, Mich.



Drafting Instrument

The new Duraline drafting instrument is said to be 6 instruments in one comprising a T-square, straightedge, triangle, protractor, scale, and parallel rules.

It reportedly requires no attachments or board clamps and measures 10¼ by 3-3/16 in.

Loomis Industries, Box 442, Berkeley, Calif.

Plastic Electrical Tape

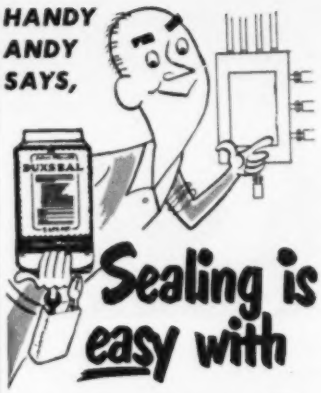
A plastic tape particularly adapted to heavy duty work, winding cables, electrical harnesses and for use with power driven taping machines has been developed.

The tape has a thickness of 0.01-in. and is claimed to have great strength and flexibility. It is stated to be resistant to weather, oils, acids, alkalies and corrosive chemicals. Dielectric strength averages 10,000 v and because of its ability to stretch it conforms well to irregular surfaces.

Van Cleef Bros, Inc, Chicago 19, Ill.

Wire Rope Cutter

This new latch-type design wire rope cutter has been developed recently. Called the Series 15 Guillotine, a click of the latch opens the anvil, the material to be cut is laid in position, and the main body of tool is raised back to vertical position



Sealing is easy with Johns-Manville DUXSEAL the permanently plastic caulking compound

WATCH DUXSEAL* GO on as easy as putty right from the handy package. Watch it make a smooth, workmanlike job. Watch it provide a tight seal on duct openings, pot-heads, bushings, terminal boxes—and for filling multi-wire contact boxes indoors. You'll want a package in your tool box at all times for on-the-spot sealing.

4 more reasons why Duxseal is a favorite:

Stays plastic—Duxseal stays plastic indefinitely. Will not slump, melt or run under ordinary temperatures.

Stays tight—Clings to duct walls and cables but flexes with expansion and contraction of the cable.

Stays insoluble—Unaffected by ground waters and gases.

Stays harmless—Will not injure workmen's hands or react with rubber, metals or painted surfaces.

Tight seals for other electrical uses:

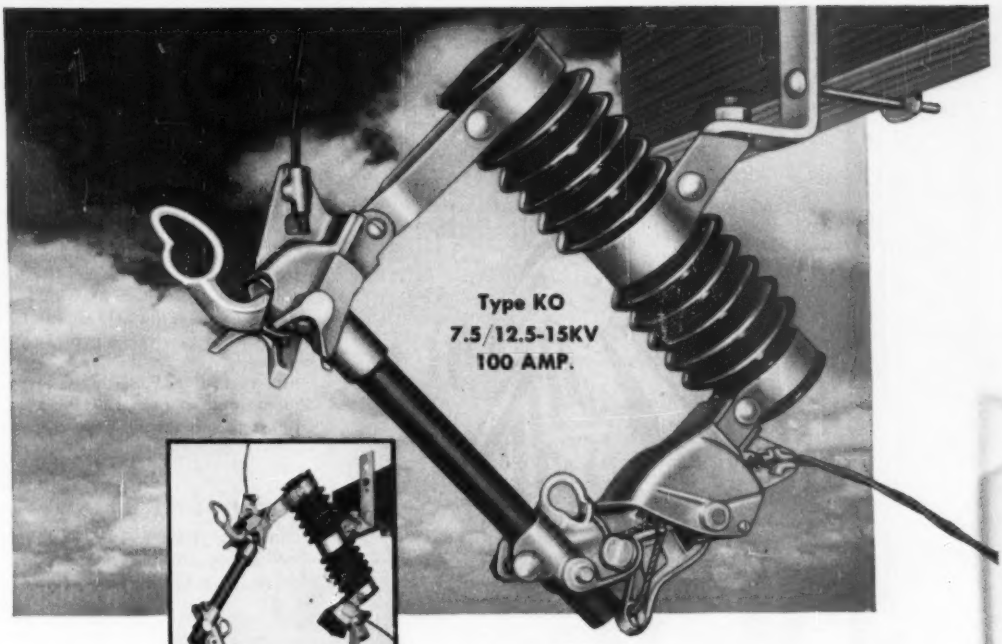
J-M Tranolseal . . . for use against refined oils employed in transformers, switches and similar equipment.

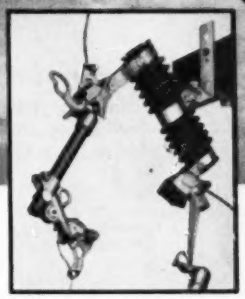
J-M Uniseal . . . for caulking equipment outdoors or in fume-laden areas. Resists temperatures up to 180° F.

If you would like to know more about Duxseal and other J-M labor-saving sealing compounds, write Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay Street, Toronto, Ontario.

*Reg. U. S. Pat. Off.

Johns-Manville SEALING COMPOUNDS





*Type KO-L, with Load Break

Only CHANCE KO gives you all these features

There's a big difference in cutouts! *Overall protection* throughout the entire interruption range—all-weather operation—positive fuse coordination—low radio noise level . . . are just a few important things to look for when choosing *your* cutouts.

Compare the CHANCE KO with any other cutout. Compare it electrically. Compare it mechanically. Test it from maximum rated interruption to your lowest currents . . . you'll find that the CHANCE KO gives top performance because the KO is the basic design for the type KO-L—which is built for load break operation.

Order through your regular supplier—specify CHANCE KO or KO-L.

1 LOAD BREAK device, optional, Type KO-L*.
2 *Overall Protection*—Proved by thousands of tests.
3 *Pry-Out Lever* for easy opening and closing. Allows the use of heavy duty contact springs without requiring extra effort to remove tube.
4 *Exclusive Ejector Mechanism* provides fast complete ejection of fuse link before contacts part—even on a low current interruption.
5 *Sleet Shields for All-weather Operation.* Protect contacts and operating mechanism and prevent water from entering the tube to cause twisting and swelling of the fiber.
6 *Mechanical Time-Delayed Contact Separation.* Prevents pitting or burning of contacts.
7 *Pivot Bracket* (E.E.I.—NEMA) for cross-arm mounting. A special bracket is available for pole mounting.
8 *Positive Semaphore Indication* to show if cutout was opened manually or by a protective operation.
9 *Easy Reloading*—simple hook stick operation from any angle.
10 *Link Element Protection*—Link tension not affected by closing action. Eliminates breakage or damage to time-current characteristics of link.
11 *Overtravel Stops*—Protect pressure contact springs.
12 *Safety to Operator*—Tube angle directs expulsion gases away from lineman when operating cutout.

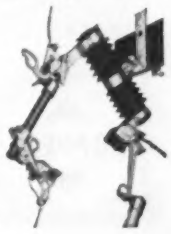
You know it's RIGHT when you specify CHANCE

A·B·CHANCE CO.

CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

* Chance Type KO-L gives load break operation with full interrupting capacity. It's not just a cutout with a load break attachment—it's *built to break loads.* This load break costs only $2.00 extra! Get full information today.



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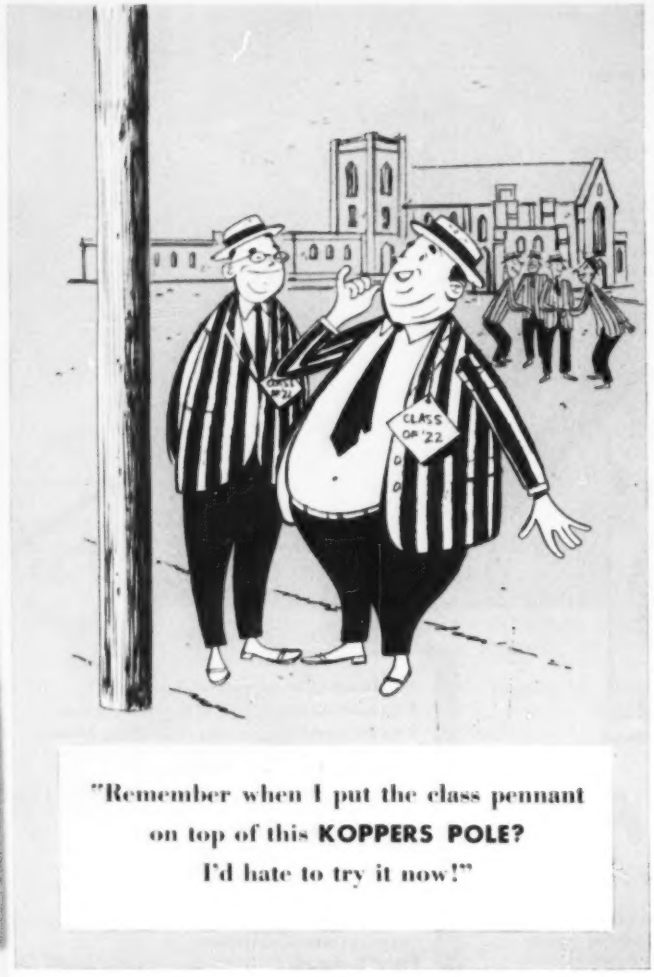


"Remember when I put the class pennant on top of this **KOPPERS POLE?** I'd hate to try it now!"

● An unfair comparison, perhaps, but this Koppers Pole is in much better shape than the "Old Grad."

Koppers Poles are famous for the way they *retain* their strength through the years. This strength-retention means less maintenance work and expense. It also cuts your replacement costs appreciably.

Specify Koppers Full-Length Pressure-Creosoted Poles. You'll get long and trouble-free pole service.

KOPPERS COMPANY, INC. PITTSBURGH 19, PA.

KOPPERS PRESSURE-CREOSOTED WOOD

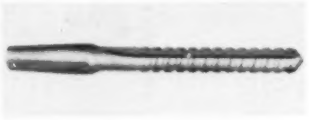
which automatically locks tool in cutting position.

Cutting time as low as 7 sec can be obtained, depending on pump assembly used.

It is claimed the cutter exerts up to 50 tons thrust which makes clean cuts through 1¾-in. wire rope. Unit weighs 75 lb.

Masonry Drill Bit

The new Thunder-Twist carbide tipped mason drill bit reportedly enables one man to drill holes in green



concrete when using an electric or pneumatic hammer and this bit.

The bit has two deep spiral vanes which speedily and easily remove dust, putting an end to packing or bending of the bit. The bit is said to allow faster drilling in granite and other hard masonry materials.

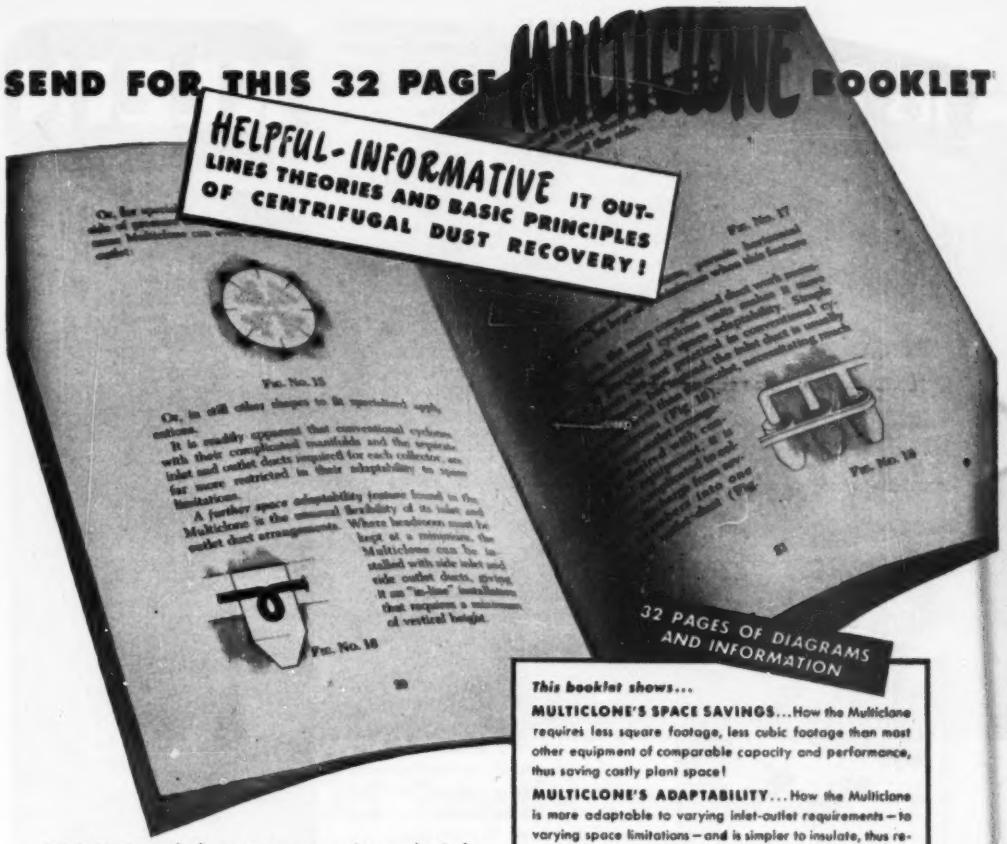
The bits are available in sizes of 3/16 to 1¼-in. diameter, up to 36-in. deep.

New England Carbide Tool Co, Cambridge, Mass.

MORE NEW PRODUCTS
about which you should know

Republic Steel Corp, Steel and Tube Div, Cleveland 8, Ohio, has announced recently **Dekoron coated E.M.T.** This plastic armored EMT is stated to give a corrosion resistant raceway. No special wrenches or tools are needed to work the product. Couplings used to connect the ends are merely covered with a plastic tape upon completion. . . . Orbit Electric Co, 2710 N. Minard Ave,

SEND FOR THIS 32 PAGE MULTICLONE BOOKLET


HELPFUL-INFORMATIVE IT OUTLINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL DUST RECOVERY!
32 PAGES OF DIAGRAMS AND INFORMATION

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

A limited supply of these booklets is available for free distribution to those interested in mechanical recovery equipment and methods. Write for your copy today.

This booklet shows...

MULTICLONE'S SPACE SAVINGS...How the Multiclone requires less square footage, less cubic footage than most other equipment of comparable capacity and performance, thus saving costly plant space!

MULTICLONE'S ADAPTABILITY...How the Multiclone is more adaptable to varying inlet-outlet requirements—to varying space limitations—and is simpler to insulate, thus reducing installation costs!

MULTICLONE'S EFFICIENCY...How Multiclone's multiple *small diameter* tubes, made possible by its exclusive vane design, give higher centrifugal forces and more complete cleansing of *all* suspended particles—even small ones of 10 microns and less!

MULTICLONE'S LOW MAINTENANCE...How the Multiclone has no high speed moving parts to repair or replace, no pads or filters to clean or renew, nothing to choke gas flow or increase draft losses as suspended materials are recovered. Multiclone draft losses remain uniformly low—recovery efficiencies uniformly high—at all times!

Make sure that a copy of this helpful booklet is in your reference files by sending for your copy now!

NOW SELLING...

COTTRELL Precipitators
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TURBULAIRE Spray Dryers

...in all parts of the U.S.A. and foreign countries.

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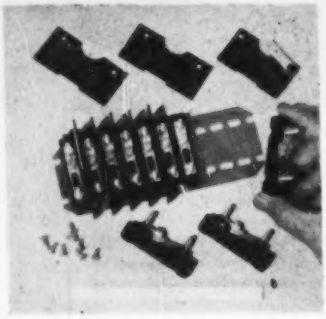
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

Special Blocks Quickly Assembled from your stock of STATES Type NT Terminal Block Units



Yes, it's true—you can stock STATES versatile NT parts and assemble special Terminal Blocks quickly and on short notice.

Mounting strip (up through 65 poles) may be obtained separately from the units in order to make up special length blocks.

NT Blocks may be obtained complete in any number of poles desired.

The sliding-link feature of STATES NT Blocks permits inserting instruments without disturbing permanent wiring. Straight strap units may be used in company with the sliding-link units.

Wire — Write — Call

Cut Out and Mail Today to

STATES COMPANY
3 New Park Ave., Hartford, Conn.

Please send full information on States Terminal Blocks.

Name ..... Title .....

Firm .....

City ..... Zone ..... State .....

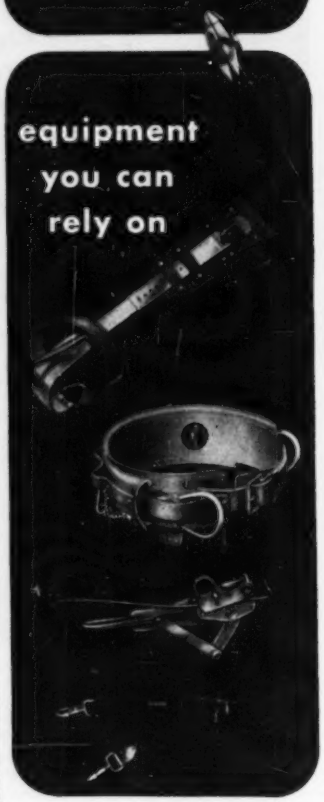
Chicago 39, Ill., has made available a new **arctangent coordinate graph paper.** The use of this paper is said to permit plotting of uninterrupted curves of data having values ranging from plus infinity to minus infinity and including zero. Uses of this paper are for plotting reactance function, etc.

Dow Corning Corp, Midland, Mich., announces **low-pressure laminates** with a remarkable degree of heat stability. Physical and electrical properties are comparable to conventional high-pressure silicone-glass laminates molded at 1000 psi or higher. Mechanical strength is superior to silicone-bonded moldings of chopped glass, mica, asbestos and inorganic filler. . . . Hazardous Area Equipment Corp, Greenwich St, N.Y.C. has developed a series of **conduit fittings** U. L. approved for the most hazardous areas defined by the N.E.C. These fittings make it possible to design a conduit system for any type of hazardous location. Fittings are aluminum alloy and come in ½ in., ¾ in., and 1 in. sizes.

Minneapolis-Honeywell Regulator Co, Philadelphia 44, Pa., announces a newly designed **console desk** arranged with cutouts to accommodate a precision indicator and key switches. As many as 96 temperature readings can be read from this one place. . . . General Electric Co, Schenectady 5, N. Y., announces **distribution transformers** with high-voltage, tank-wall bushings. They are claimed to have smaller dimensions, an improved gasket seal for insuring oil tightness and better electrical characteristics than present day transformers using pocket type bushings.

Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa., recently developed a new type **centrifugal fan** that is reportedly over 90 percent efficient. Only one-third of the noise intensity of previous models is a feature. The new fan ranges in sizes from 40¼ in. to 108¾ in. in diameter. It is capable of handling 600,000 cubic feet per minute. . . . Rodale Mfg Co, Dept EW, Emmaus, Pa. announces an unbreakable and shockproof 2-wire soft rubber cord **connector body** that is especially designed for heavy duty industrial service. It is rated at 10 amp, 250 v and also 15 amp, 125v.

KLEIN



Talk to any old-timer on the job and he'll tell you Klein equipment is his choice for comfort—for safety—for service. Look for the familiar Klein trade-mark on pliers, safety straps and belts, climbers, grips and wrenches. Klein has been serving the electrical industry "Since 1857."

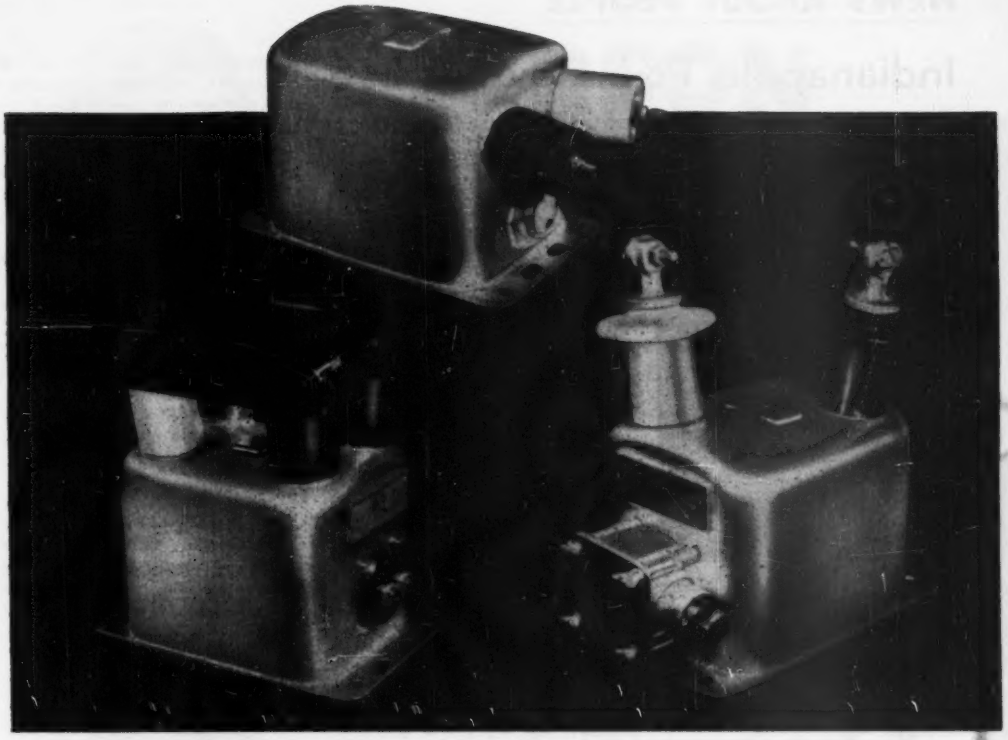
ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

Write for your free copy of the Klein Pocket Tool Guide today!

"Since 1857"

Mathias **KLEIN** & Sons
3200 BELMONT AVE. CHICAGO 18, ILL.



NEW 2400-VOLT Potential Transformers

EASIER TO MOUNT . . . IN ANY POSITION!

Completely redesigned . . . inside and out . . . the new Westinghouse 2400-volt Potential Transformers are easier to handle, may be installed in any position.

In addition to improved mechanical design, these transformers have compact, lightweight Hipersil® Cores, and new crepe-paper insulation. Vacuum drying, then plastic impregnation and filling under vacuum, results in exceptionally low-insulation power factor, high impulse and dielectric strength. These transformers meet ASA standards for metering and relaying accuracy.

All units are enclosed in deep-drawn steel cases, the only weld being where the base joins the side walls. A new filling plug, plus flangeless bushings, assures leakproof connections.

The new Westinghouse 2400-volt Potential Transformers are available with or without fuses, Type PT for indoor or Type PTO outdoor service. For further information, contact your Westinghouse representative or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-70635

YOU CAN BE SURE...IF IT'S

Westinghouse

INSTRUMENT TRANSFORMERS

Indianapolis P&L Elevates Lee

Personnel and public relations head is designated as senior vice president. Schotters is made a vice president

W. O. LEE

B. W. SCHOTTERS

Wallace O. Lee has been named senior vice president of Indianapolis Power & Light Co. The company also promoted Bernard W. Schotters to the new office of vice president and secretary.

Lee, who is vice president in charge of personnel and public relations and also a director of the company, was elected to the senior vice presidency because of his long and successful career with Indianapolis P&L. Starting 42 years ago as a salesman for the former Indianapolis Light & Heat Co, he entered personnel and public relations work for the present company in 1927. He was elected a vice president in 1936 and was made a director of the Indianapolis utility in 1937.

Studied Law . . . Schotters, who has served the company for 26 years, has been secretary and head of the legal department since 1945. He started as a clerk in the stores department and in 1928 became assistant purchasing agent. While employed by the utility he studied at night at the Indiana Law School and upon graduation and admission to the bar in 1935 he was transferred to the legal department.

After being elected assistant secretary in 1940 he was called to active duty in the Marine Corps. He served in the Pacific area until he returned to Indianapolis P&L as secretary in 1945.

•

Robert H. Pell, manager of Monongahela Power Co's Panhandle Division since 1944, has been appointed assistant in charge of power generation to Vice Pres Don B. Potter. Pell is expected to continue, for the present, management of the Panhandle Division, dividing his time between Wellsburg, the division's headquarters, and general offices at Fairmont. Pell, who joined the utility in 1930, will assume full responsibility of the new post late this summer.

David B. Lawton, former assistant manager of manufacturing of General Electric Co's transformer operations at Pittsfield, Mass., has been made manager of General Electric's newly planned transformer manufacturing plant at Rome, Ga. Lawton started with General Electric in 1929 and was named to the Pittsfield managerial post in 1951.

N. P. Woods, vice president and treasurer of Shawinigan Water & Power Co, has been appointed vice president-finance and treasurer. The company also announced that **Leo E. Boissonnault,** formerly Montreal representative and member of the management committee of Canada's Foreign Exchange Control Board, has been named assistant to the vice president-finance. **Russell R. Merifield,** formerly with Shawinigan Chemicals Ltd, has been made assistant secretary of the parent company.

Frank J. Pfeiffer, vice president and secretary of Louisville Gas & Electric Co since 1948, has been elected vice president and comptroller. The utility also elected **W. J. Glover,** formerly assistant vice president, secretary and assistant vice president. **A. J. Kieffer,** who has served as assistant vice president, was made assistant vice president and assistant treasurer.

George R. Roberts, with Toledo Edison Co for 32 years, has been named superintendent of the company's transformer department succeeding **William A. Hill,** retired. Roberts has been assistant superintendent of that department since 1951.

M. C. ALBRITTAIN

Consolidated of Baltimore Promotes M. C. Albrittain

Mason C. Albrittain has been appointed general sales manager of Consolidated Gas Electric Light & Power Co of Baltimore. In this new post he will be responsible for all sales and promotional activities of the company.

With Consolidated for 28 years, Albrittain has been general manager of industrial and commercial sales and promotion since 1949. Prior to this

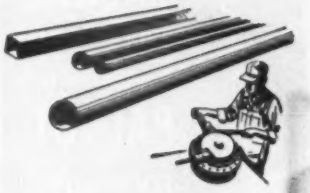
RYERSON

Steel Department Store for Electric Utilities

Here are a few of the many types of steel and related products on hand right now, ready for immediate shipment from your nearby Ryerson plant. Many may be used in place of products that are still hard to get. Check the items you need, and save time by ordering them next time you call Ryerson.

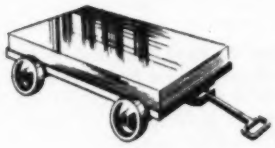
ALLOYS

Tested alloys of known hardenability, both standard and aircraft quality. Complete heat treatment guide with each shipment.



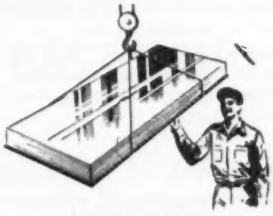
WELDED MECHANICAL TUBING

Hot and cold rolled, rounds and squares in a wide range of sizes. Consider cost. Substitute for seamless tubing.



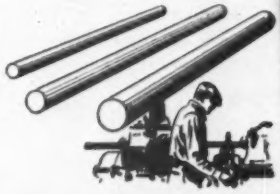
CARBON SHEETS

Both hot and cold rolled coming into better supply, especially cold rolled in the heavier gauges.



STRAIGHT CHROME STAINLESS

No allotment required for these stainless bars, plates and sheets—and they can often replace restricted nickel-bearing types.



TOOL STEEL

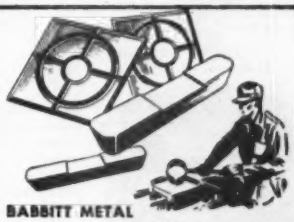
Water, oil or air hardening steel. High in quality; economical in price. Hardening data with every shipment.

SAFETY PLATE

Strong, non-skid Inland 4-Way Safety Plate protects feet against slipping, floors against wear. Easily fabricated.

CHAIN & WIRE ROPE

Rugged, dependable TM chain, iron, steel and alloy qualities, furnished to order. High quality wire rope shipped from large stocks.



BABBITT METAL

Glyco Babbitt, an exclusive Ryerson product, has physicals equal to high tin Babbitts; costs substantially less and is unrestricted.

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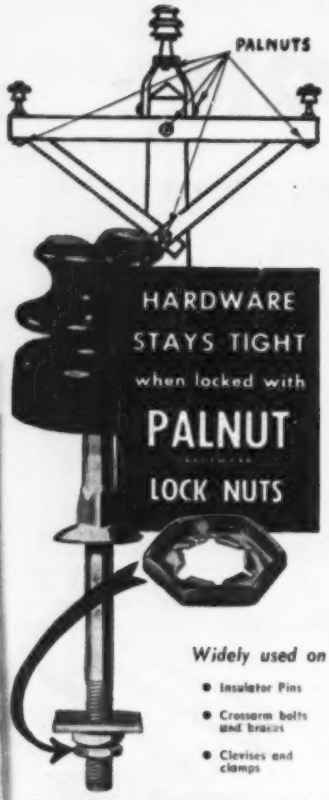

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appointment he was assistant general manager of the industrial and commercial department.

Vepco Elevates Hawkins; 6 Others Are Reassigned

Virginia Electric & Power Co has made several managerial changes which will become effective July 1.

James B. Hawkins, manager of the Blue Ridge district at Charlottesville, will become assistant vice president of the company with headquarters in Norfolk.

B. J. Dorsey, manager of the Peninsula district in Newport News, has been named manager of the Blue Ridge district in Charlottesville. W. W. Waldrop, manager of the Southside district at South Boston, has been assigned to Newport News as manager of the Peninsula district. Waldrop's successor as Southside district manager will be Walter J. Matthews, director of Vepco's employee information program at Richmond.

George F. Duborg, manager at Arlington, will be transferred to Norfolk as manager of that area. His successor in Arlington will be G. G. Hollinshead, manager at Suffolk. L. E. DeMoll, manager at Waynesboro, will become manager at Suffolk.

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Myron Ceresa has been appointed section manager of electroplating projects for the Special Products Development Division of Westinghouse Electric Corp. Ceresa, who joined Westinghouse in 1937, became a member of the electroplating projects section at East Pittsburgh in 1947.

C. R. Machen has been appointed East Bay Division electric superintendent of Pacific Gas & Electric Co, succeeding Melville N. Clark. The position carries full responsibility for electric operations of the company in Alameda and Contra Costa Counties. Machen takes over after serving as electric superintendent of the De Sabla Division at Chico, Calif., which position will be filled by **George S. Brand.** Machen has been with PG&E since 1926.

E. M. Kline has been made general manager of the Huntington (W. Va.) Works of International Nickel Co, Inc, effective July 1. He succeeds **Herman M. Brown,** who retires today, June 30, after 31 years' service with Inco. **G. K. Crosby,** who joined Inco in 1936 and has been general superintendent of the Huntington Works since 1947, succeeds Kline as assistant general manager of the works, a post he held since 1947. Kline began with Inco in 1923.

Miller, Blount Assigned to New Posts by Bakelite

In announcing a program for consolidation of all its sales activities, Bakelite Co, a division of Union Carbide & Carbon Corp, elevated two sales executives.

George C. Miller has been named vice president in charge of sales and will be responsible for all the company's sales. Clinton W. Blount becomes vice president and general sales manager.

Miller and Blount were previously vice presidents and general sales managers of the former thermoplastics and thermosetting departments, respectively, whose sales activities have been consolidated under the new program.

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Ivan P. Head, civil and hydraulics engineer with the Bureau of Reclamation in project investigations and hydrology positions for 16 years, has been named assistant regional planning engineer for the bureau's Region II in Sacramento, Calif. Head, who has been serving as a member of the hydrology branch in the bureau's Denver, Colo., office, succeeds **Oliver H. Folsom,** who has resigned.

Robert H. Harris has been named assistant manager of Rheem International, a division of Rheem Manufacturing Co. He will make his headquarters in New York. Before joining Rheem, Harris was general sales manager of Westinghouse Electric International Co. He joined the Westinghouse firm in 1935.

OBITUARY

G. N. Tidd

George Nathan Tidd, 78, former president and chairman of the board of American Gas & Electric Co, died June 17 at New York.

Tidd became vice president and general manager of American G&E in

G. N. TIDD

1909. He was president of the company from 1923 until 1947. He served as chairman of the board and of the executive committee until 1950 when he resigned, but remained as a director and consultant to the company.

He started his utility career as manager of the Waverly & Sayre Electric Co, Waverly, N. Y., and went on to the managership of Beacon Light Co, Chester, Pa. In 1904 he was appointed manager of the Marion (Ind.) Light & Power Co, and later was associated with Muncie (Ind.) Electric Light Co. These two companies were among the seven which originally made up American G&E, organized in 1906. He joined Scranton Electric Co, an American G&E subsidiary, in 1907.

Tidd was active in Edison Electric Institute and the Association of Edison Illuminating Companies.

George W. Eppler, 55, general manager of the Monongahela Division of Combustion Engineering-Superheater, Inc, died June 8. Eppler joined Combustion Engineering in 1923 and was advanced to general manager in 1950.

Herbert B. Shaftoe, 67, former vice president of United Electric Railways Co, Providence, R. I., and later assistant treasurer of the New England Electric System, died at Weymouth Heights, Mass., June 9. He retired from the latter post about 18 months ago.

J. Frank Deakyne, 51, manager and electrical engineer of Seaford (Del.) Light & Power Department, died June 10 at Seaford. He became affiliated with the department in 1937.

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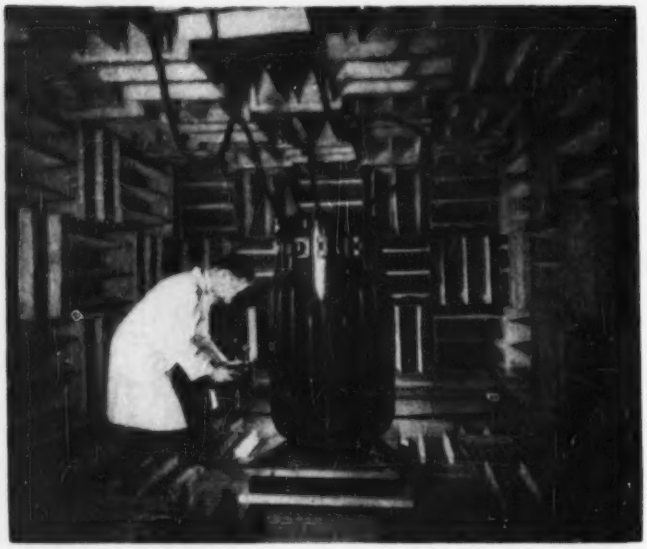

WESTINGHOUSE research engineer Charles H. Smith is seen measuring the intensity of the very slight hum produced by transformer in firm's anechoic chamber. The special room, which has no echo, was constructed as the center of operations in the company's new acoustics laboratory, Pittsburgh. Here scientists study noise of electrical equipment

Completes Sound Laboratory

Westinghouse's new unit has an anechoic chamber which will be used to study noise of electrical equipment

Reverberation of sound is nonexistent in the anechoic chamber in Westinghouse Electric Corp's new sound laboratory which is located in a suburban area of Pittsburgh, Pa., where the surrounding noise level is quite low. The room will enable research engineers to study noise—its source, cause, and measurement.

According to Dr Patrick Conley, manager of acoustical research at Westinghouse Laboratories, elimination or reduction of noise in the present lines of Westinghouse equipment is valued at close to $100,000 every year for each decibel of sound diminution.

Wedges Determine Efficiency . . . Inside the lab's main building and surrounded by masonry walls 12 in. thick, a 19x13x10 ft room has had its walls, roof, and floor completely covered with insulating material shaped in the form of wedges. The wedges are the heart of the anechoic chamber for it is their shape, composition, size, and number that determine the efficiency of the room. Each wedge, fabricated from glass wool, is 8x24 in. at its base and 34 in. long. Wire mesh with ½ in. openings encases each wedge to facilitate installation and protect the easily damaged filler.

A spring supported wire net is stretched from all four side walls several feet above the wedges which cover the floor of the room. This working platform will support equipment to be tested. Overhead, necessary types of service lines are available to operate the various test pieces. Since only the noise source plus a microphone pickup will be inside the chamber during test runs, all gauges and recording instruments are located on control panels in an adjoining room.

No Echoes . . . In a so-called "free sound field," such as would exist at an altitude of 50 or 100 miles, sound waves would flow forth from a source in all directions and their intensity would decrease as the inverse square of the distance from the source. This would, of course, preclude the presence of any kind or magnitude of background noise. Since there would be no surrounding walls or obstacles in this "free field," no reflections of sound would occur—hence no echoes. These are the physical factors that Westinghouse's engineers have struggled against to build into the anechoic chamber.

The quiet location of the laboratory and the type of wall construction have produced a very depressed ambient sound level. The design of the wedges themselves absorbs and prevents reflection of sound waves. A sound level within the room of 10 to 15 decibels is anticipated, according to Dr Conley. In comparison, a residential neighborhood at night has a noise level of 25 to 30 decibels.

Charles H. Smith, who is in charge of the lab, said decibel values are used to express the ratio of the intensity of one sound to another. One decibel is approximately the smallest difference in sound intensity a normal human ear can distinguish.

One of the problems that will be studied in the new sound laboratory will be that of determining a standard method of measuring noise since the technique of measurement throughout the industry varies widely. This variance has led to confusion and in some cases rather large unnecessary expenditures.

Other investigations are expected to lead to sound reduction in many types of Westinghouse equipment including transformers, ballasts in fluorescent lighting fixtures, refrigerators, vacuum cleaners, air conditioning units, speakers for home radios, and jet engine test cells.

Long-Range Plans . . . Dr Conley pointed out that the sound study program will not be a rapid one with solutions to present noise problems as their immediate goal.

"We must first," he said, "understand thoroughly the detailed causes of the various sounds, their means of propagation and radiation, and their psychoacoustic effects—the effects on the human ear of sound level and frequency. With these problems solved, various apparatus noises can be reduced or eliminated more easily."

New Method . . .

. . . for mica-strip production introduced. Plant set up for manufacture of product

Many phases of the so-called mica problem have been solved, according to Moses D. Heyman, who organized and owns the Integrated Mica Corp, Woodmere, N. Y.

Pilot Plant Completed . . . Heyman claims he has a new process he is using to make mica strips from both mica waste and synthetic mica supplied by the U. S. Bureau of Mines. A pilot plant for the manufacture of this product was completed this year.

Heyman reports he has developed synthetic strips of mica, some more than 50 ft in length with thickness up to ⅛ in., that have a far wider range of usefulness as an electrical insulating material than any mechanically made mica yet developed anywhere.

One form of integrated mica is made by taking ordinary mica waste which is now mined in large quantities in different sections of the country and splitting it up into flakes that are less than four microns in thickness. Heyman contends the important discovery has been made that if these flakes do not have their surfaces marred they can be caused to recohere so as to form a solid sheet which will hold together without a binder.

Key Apparatus . . . The key piece of apparatus is a machine called a disintegrator, which splits millions of flakes per minute at a very low cost, without damaging the delicate mascent surfaces of the scrap material. These are then floated out into a water bath and allowed to settle upon a moving belt which is afterwards run through a dryer and thus form a cohesive sheet of mica. The material can be given various degrees of porosity or can be made highly water resistant by impregnation with different resins.

Heyman maintains that in 1949 he produced the first continuous sheets of pure mica and announced it before a meeting of the Conference of Electrical Insulation of the National Research Council. A year later he exhibited before the Military-Industrial Round Table Conference in Washington the largest piece of artificially made pure mica in existence.

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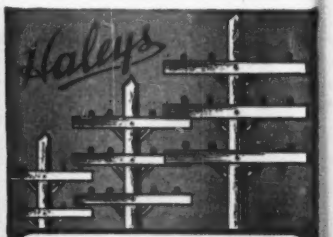

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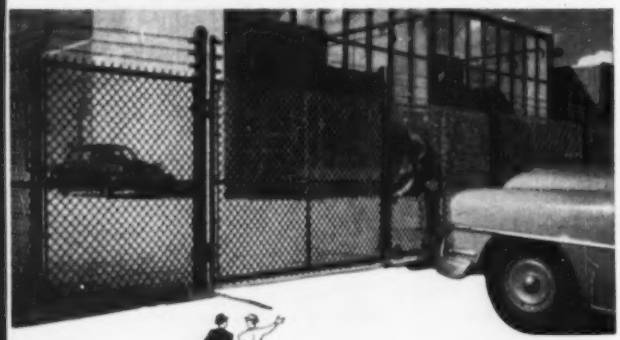

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New Electrical Construction

New electrical construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included.

UTILITIES

Proposed Construction

Arizona-Nevada—Bureau Reclamation, Dpt. Interior, Bldg. 54, Denver Federal Center, Denver, Colo., circuit breaker, disconnecting switches, grounding blades, etc., for Cochise Sub-station, Davis Dam Proj. Spec. DS 3725. L. N. McClellan, ch. engr.

Colorado—Bureau Reclamation, Dpt. Interior, Grand Lake, reconstructing Green Mountain Switchyard, Colorado Big Thompson Proj. Spec. 704C-263. L. N. McClellan, Bldg. 1A, Denver Federal Center, Denver, ch. engr.

Fla., Jacksonville—Dpt. Navy, Officer in Charge of Construction, Box 5, U. S. Naval Air Station, Jacksonville, addnl. power supply, overhaul and repair Bldg. 101, NOY 74188. Plans deposit $10.

Ind., Terre Haute—Contg. Officer, Bldg. 105, Terre Haute Ordnance Depot installing electrical distr. facilities in Sections "A" and "B" of Warehouse T-102, Serial No. ENG 12-052-52-430.

Ia., Hartley—City, building modifications, generating unit, misc. outside work for power plant. Kruse Eng. Service, Spencer, engr.

Md., Edgewood—U. S. Eng., 24 St., and Maryland Ave., P. O. Box 1715, Baltimore, Zone 3, control tower, Army Chemical Center, Eng. 18-020-52-62. Turpin, Wachter & Assoc., 1004 N. Charles St., Baltimore, engrs. and archts.

Md., White Oak—Dist. P. Wks., Office, Potomac River Naval Command, Naval Gun Factory, Wash., D. C., installing addnl metal clad switchgear unit, constr. underground duct line, underground cable, overhead line, outdoor transformer substation at Naval Ordnance Laboratory, NOY 73377, Spec. 34503. Plans deposit $10.

Mass., Charlestown—Dist. P. Wks. Office, First Naval Dist., 495 Summer St., Boston, bldg. 198 Electronics School, Boston Naval Shipyard, NOY 72022, Spec. 32476. Plans deposit $10.

Minn., Aitkin—Village, Light and Power Comn., T. R. Hassman, chn., furnish, install diesel engine electric generating unit, 1,600-1,800 hp., auxiliary equip., municipal power plant. $135,000. Plans deposit $15. T. E. Roche, 517 Sexton Bldg., Minneapolis, engr.

Miss., Yazoo City—City, City Hall, 13,800 volt and 4,160 volt overhead electric lines.

N. M., Alamogordo—U. S. Eng., Box 1538, Albuquerque, ground-powered equipment repair shop, $250,000; electronics and atmospheric research test bldg., $250,000; technical projects bldg., $100,000, Holloman Air Force Base, Eng. 29-005-52-49.

N. M., Albuquerque—U. S. Eng., Box 1538, electrical distr. sys., Eng. 29-005-52-73, $60,000.

N. Y., West Point—Contg. Officer, Military Academy, West Point, underground electrical distr. system, West Point Military Academy, Inv. 107.

Oregon—U. S. Eng., Pittock Block, Portland, 6,300 lin. ft. multiple conductor cable at Detroit Dam, CIVENG 35-026-52-215; 3 lightning arresters at Detroit Dam Power House, CIVENG 35-026-52-216, Marion Co.

South Carolina—Blue Ridge Electric Co-operative, Pickens, 24.19 mi. new and 84.69 mi. conversion of rural distr. lines in Oconee and Pickens Counties. Plans deposit $10.

Tennessee—U. S. Eng., 303 Federal Office Bldg., Nashville, 36,000 kw. power house for Chetham Dam, Cumberland River, $18,000,000.

Tex., Fort Worth—City, c/o W. O. Jones, mgr., City Hall, street lighting at Greater Fort Worth International Airport, incl. sub-station, under ground cables, etc. $142,000. Wyatt C. Hedrick, Inc., 1005

First Natl. Bank Bldg., engr.

Tex., Houston—City, City Hall, 900 Brazos St., emergency power unit, 2 turbine pumps, $60,000; natural gas distr. hot and cold water piping, water meter equip. fire hydrant sys., 2 chlorinator, 25,000 gal. elevated steel water storage tank, $206,580; 20x69 ft. concrete substructure for pump station, filter stations housing, $65,000; electric switchgear, pumps, piping, 2 pressure filters, 2 turbine pumps, $55,000; heating and ventilating sys., $65,000; 33x125 ft. concrete pump equip. storage, $90,000; Intake foot bridge, completion intake tower, $85,000; concrete walks, parking areas, landscaping, grading, $60,000; electrical work for electric lighting and power installations, $70,000; sanitary drainage, $60,000, for Lake Houston Pumping Station on San Jacinto River. Lockwood & Andrews, 904 Union Natl. Bank Bldg., engrs.

Tex., San Angelo—West Texas Utilities Co., Abilene, turbo-generator electric power plant unit, $3,954,000.

Va., Norfolk—Dist. P. Wks. office, Headquarters, Fifth Naval Dist., U. S. Naval Base, Zone 11, addtl. power facilities Commander in Chief Atlantic Fleet Headquarters, Naval Base, NOY 71293, Spec. 32862. Plans deposit $10.

Va., Portsmouth—P. Wks. Office, Headquarters, Fifth Naval Dist., U. S. Naval Base, Norfolk, Zone 11, installing standby generators at U. S. Marine Corps Forwarding Depot, NOY 72484, Spec. 33658, Plans deposit $10, rehabilitation of electrical service, flood and security lighting at Norfolk Naval Shipyard, NOY 72454, Spec. 33633, plans deposit $25.

Alaska—Chugach Electric Assn., Anchorage, installing 3,000 kva. unit substation, at Anchorage. H. W. Beecher, Arcade Bldg., Seattle, Wash., engr.

Alaska—Bureau Reclamation, Dpt. Interior, Bldg. 53, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Eklutna, two 115,000 volt, 3-pole, 800-ampere, 1,500,000 kva. interrupting rating outdoor power circuit breakers; 3 single-pole, self-supporting, station-type lightning arresters, suitable for base mounting, for 115-kilovolt grounded-neutral circuit; two 115,000-volt, 600-ampere, 3-pole, single-throw, manually-gang-operating, outdoor disconnecting switches with grounding blades, three 115,000 volt, 600-ampere, 3-pole, single-throw, manually-gang-operating, outdoor horn-gap switches; and two 115,000 volt, 600-ampere, 3-pole single-throw, manually-gang-operated outdoor disconnecting switches for Eklutna switchyard, Eklutna Proj., Inv. No. DS-7737.

Low Bidders & Contracts Awarded

Miss., Vicksburg—Kaiser Engineers div. Kaiser Industries, Inc., 1924 Broadway, Oakland, Calif. CA total est. $3,000,000, plant. Westinghouse Electric Corp., 1370 Ontario St., Cleveland, O.

Oregon—Urban Plumbing & Heating Co., 2904 S.W. 1st. St., Portland, Ore., CA. $548,051, furnish, install equip., Detroit Dam. Power House. CIVENG 25-926-52-136, Marion Co. U. S. Eng., Pittock Block, Portland, Ore. Bids May 20, awarded June 3.

Texas—West Texas Utilities Co., Abilene, Tex., Own Forces, $100,000, addnl. unit electric rural power lines, at Obona, Crockett Co.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Mich., Lansing—City, Mayor Ralph W. Crego, City Hall, plans by Orlie J. Munson, 409 Wilson Bldg., Lansing, brick, steel, concrete, stone civic center, auditorium, $3,500,000; civic office, $1,000,000; Prudden Memorial Theater, $1,500,000.

Va., Sunbright—Foote Mineral Co., Sunbright, plant addn. $3,000,000.

W. Va., Huntington—International Nickel Co., Huntington, W. Va., plant addn. $1,400,000.

Low Bidders & Contracts Awarded

Wis., Baraboo—Fegles Constr. Co., 711 Wesley Temple Bldg., Minneapolis, Minn., CA. Approx. $16,000,000, rehabilitate powder plant at Badger Ordnance Works, U. S. Eng., Office The Resident Engineer, Baraboo, Wis. Awarded June 5.

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3	75	A. C.	66000—2400/—7200/12470 Y
3	200	West.	45000—2400/7200
4	2500	West.	44000—11000
3	150	G. E.	44000—7200/12470 Y
3	100	G. E.	44000—2400
3	75	West.	44000—7200/12470 Y
3	5333	West.	43800—13990
3	5000	G. E.	38100/66000—6600
1	18750	A.B.B.	34840—11000 3 ph.
3	900	G. E.	33000—2300, 3 ph.
3	100	West.	33000—240/480 NEW
3	100	A. C.	33000—7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
4	450	A. C.	25410/44000—13280/23000
6	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
3	37½	G. E.	22000—6900
6	200	G. E.	13200—2300
4	750	G. E.	11000—440
3	250	Pitts.	7200—220/440
6	25	Mol.	7200/12470 Y—120/240
3	333	Pitts.	6900/11900—550
3	150	Wag.	6900—2300
3	200	G. E.	6900/11430—575
3	37½	G. E.	6900—230/460
2	100	G. E.	4800/2400—480/240
3	333	G. E.	2300—230/460
1	100	G. E.	2300—575, 3 ph.
3	100	West.	2300—460/230
3	75	Mol.	2400—120/240
6	50	West.	2400—114/228 DRY TYPE
3	20	West.	2200—575

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1— 600 A. 37 KV G. E. FHKO-236-500 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
1— 600 A. 15 KV G. E. FKO-139-350 MVA
1— 600 A. 15 KV G. E. FHKO-139-1325-18
4— 600 A. 15 KV G. E. FHKO-139-730 MVA
2— 600 A. 15 KV G. E. FLO-15-240 MVA

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1	—750	G.E.	Condensing — 435 lbs. 750 "TT I.S.P. 440 v. 3 ph. 60 cy.— Built 1944
1	—80"	Moore	Non-condensing, 180/200 lbs. I.S., 5/35 lbs G.B.P. 2/60/480 volts Direct Connected Exciter
1	—400	Westg	Non-condensing — 125/150 lbs. I.S.P. 5/10 lbs. B.P. — 240/480 v. 3 ph. 60 cy.
1	—300	G.E.	Non-condensing 150/175 I.S.P. 5/10 B.P.— 480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

KVA	Make	Type	Volts	Speed
1—6000	Whse		2400/4150	600

MOTOR GENERATOR SETS
3 ph. 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
1—	2000	G.E.	300	600 75 cy	11000
1—	1000	G.E.	721	275	13200
1—	1000	G.E.	900	275	2300/4400
1—	1000	G.E.	900	300	4160/6900
1—	1000	G.E.	900	600	2300/4160
1—	800	Whse.	900	600	2300/4160
1—	800	Whse.	900	250	6900/13200
1—	800	Whse.	1200	125/250	2300
1—	800	Whse.	1200	250	440/2300
1—	800	Whse.	900	250	440
1—	800	G.E.	720	125	2300
1—	600	G.E.	720	250	440/2300
1—	400	G.E.	720	250	4160
1—	250	G.E.	900	125	440
1—	150	G.E.	1200	275	2300
1—	150	Whse.	1200	275	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
3—1250	G.E.	HVDDJ	3	6900x550
3—1250	G.E.	HT	3	2288./12500x440/2300
1—1150	A.C.	6166C	3	13800x480/240Δ
3—1000	G.E.	HVDDJ	1	2200x1650
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6—	300	G.E.	HT	3	2400x240, 480

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1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	450	1200
750	General Motors	12-567	1080	720	200	General Motors	8-268A	350	900
800	General Motors	8-278A	780	720	100	General Motors	3-268A	150	1200
800	General Motors	8-567	720	720	100	Worthington	BB-8	150	600
380	Baldwin	VO-6	510	450	60	General Motors	6-71	90	1200
330	Buckeye	80	480	600	30	Internat'l Harvester	UD-14	45	1200

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1—1500 KVA Ferd., 3 ph., 4160V. Y 2400V Delta
1— 200 KVA G.E., 3 Ph., 2400-220 Sec.
3— 100 KVA Wagner, 1 Ph., 240V pri., 120V sec.
2— 100 KVA Newark, 4400V 3 Ph. 220V 2 Ph.
6— 50 KVA G.E., 1 Ph., 13,450V. 120/240 Sec.
5— 25 KVA G.E., 1 Ph., 660V. pri., 110/220 sec.

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1— 150 H.P., G.E. 1150 RPM, 220V.
3— 150 H.P., Al. Chal. 360 RPM, 440V.

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1— 200 KW Whse., 275V. 900 R.P.M., 2200 V 3ø.
1— 175 KVA Westg., 1 Ph., 220V., Motor 3 Ph., 440V.
1— 150 KW. G.E., 125/250V. 1200 RPM, 2300 3ys
1— 100 KW G.E., 250V. 900 RPM, 2300V. 3ys.
1— 75 KW C.W. 250V. 1200 RPM, 2300/3150V 3ys.

SLIP RING MOTORS

1— 200 H.P., West. CW, 600 RPM, 440V.
1— 250 HP West., CW, 600 RPM, 440V.

SYNCHRONOUS CONDENSER

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1—2500 KVA Whse., 720 RPM. 2300V with DC EXC.

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LETTERS TO THE EDITOR

An Editorial Approved—That Was Well Received

To the Editor:

Sincere congratulations on your June 2 editorial, "A Silly Question." I wish you could stick with the theme—not cost of electric home heating (that will take care of itself), but electric utilities telling their customers that electricity costs too much—and hammer at it month after month.

Your editorial is the first time I have seen this idea put into print, and I think it is beautifully done. I personally have had occasion many times to object to statements by utility people that electricity costs for this or that new service would be too much. Or that rates would have to be raised slightly for the new service and again that that would make the appliance or equipment operating costs too high.

I wonder if the explanation of this apparently very prevalent thought among utility people may stem from that insidious short-selling campaign which the utilities have carried on for years; namely, that price of electricity keeps going down and down while everything else goes up. I have always felt that that advertising theme was a negative sort of thing which eventually would do more harm than good. Customer and company alike are now so throughly conditioned to the idea of continually lower and lower rates that there has to be a terrific negative response to any thought of rate increase. The pathetic part is the very thing you point out in your editorial—that electric utilities tell their customers that electricity costs too much!

I think it needless to say that what I have written here is not to be construed in any way as Westinghouse Co thinking. This is purely a personal idea and I feel so strongly about it I just had to let you know.

George M. Damon
Special Products Development Div
Westinghouse Electric Corp
Pittsburgh 30, Pa.

• Thank you Reader Damon. We too feel strongly about this subject. So you will probably find this idea repeated in the future.

A Welcome Kick—That Was Well Deserved

To the Editor:

In the May 12 issue on page 50 there is a chart with explanatory paragraphs below it. The year in the chart which shows 1956, I am assuming should be 1952. The chart curve marked "steel" apparently rose substantially during 1950 and 1951, but the second paragraph below this states: "the union hadn't had an increase since December 1949." This does not check with the following statement by Mr Clarence B. Randall, president of the Inland Steel Co, "during the 12 months following the last wage increase, which was Dec. 1, 1950, the average hourly wage of our workers. . . ."

I call this to your attention because it seems to me that these pieces of information conflict. Also, I think that the chart is misleading in that it gives the appearance that the cost of living is higher than electric utility wages. Of course, this is merely due to a choice of scale, but I would think that a better arrangement would be to start these two curves off together and show that utility wages were now considerably above the cost of living.

I hope you don't mind my kicking when I see something I don't agree with.

Harding U. Greene
Vice President
Cambridge Electric Light Co
46 Blackstone Street
Cambridge 39, Mass.

• On the contrary, Reader Greene, we welcome the kick that we so well deserve. You are quite right—1952 was meant where 1956 was used.

The last steel wage increase was Dec. 1, 1950 and not a year earlier as we stated. Actually the chart shows that. However, steel wages as shown on the chart also include a substantial increase in overtime pay between 1949 and 1950.

You are right that it is the choice of scale that makes the cost of living appear to be higher than utility wages. But it is obvious that the line showing utility wages is more strongly upward than that showing the cost of living.

Operating Errors

To the Editor:

May I enter my personal comment on your April 21 editorial "Insult to Intelligence"?

Your comment that operators are usually unexcitable may be true, but many, many errors are made in control room operation that are attributable, not to the operator getting excited, but to the opposite extreme, complete relaxation that makes him perform operations without thinking.

At the operators' requests over the years, we have made special significant changes in design to prevent mistakes. One is to standardize on switch handles of distinctive shapes so that when an operator grips the wrong handle, the shape warns him of error. At their request, instruments have been grouped to prevent error in reading. Mimic buses, color coded, are a must with all operators. Many of our operators strongly approve color coded instruments. Special distinctive name plates are added to our designs at the operators' request to prevent errors.

I have talked to many operators about these psychological aids and have never found one who felt that none of these aids should be provided. Some felt all are desirable. Some felt that all were not necessary but still had their preferences for some. The few operators opposed to such aids may not be the best operators.

These aids are not designed to prevent an operator becoming excited or to make his use of intelligence unnecessary. They are solely to assist him in avoiding errors from memory lapses and to find more quickly the device he wants and to operate it more quickly in emergency.

An analysis of a number of system disturbances resulting in part from operating mistakes indicates that some form of coding, either color, shape, or geographical segregation, would have helped the operator, and in our opinion, very probably reduced the chances of mistakes.

W. B. Morton
Station Electrical Engineer
Pennsylvania Power & Light Co
Allentown, Pa.

• Our thanks to reader Morton for a lucid statement of how coded controls help reduce operating errors.

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...*Cut Customer Complaints*

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	2500 VOLTS — 100-200 AMPS

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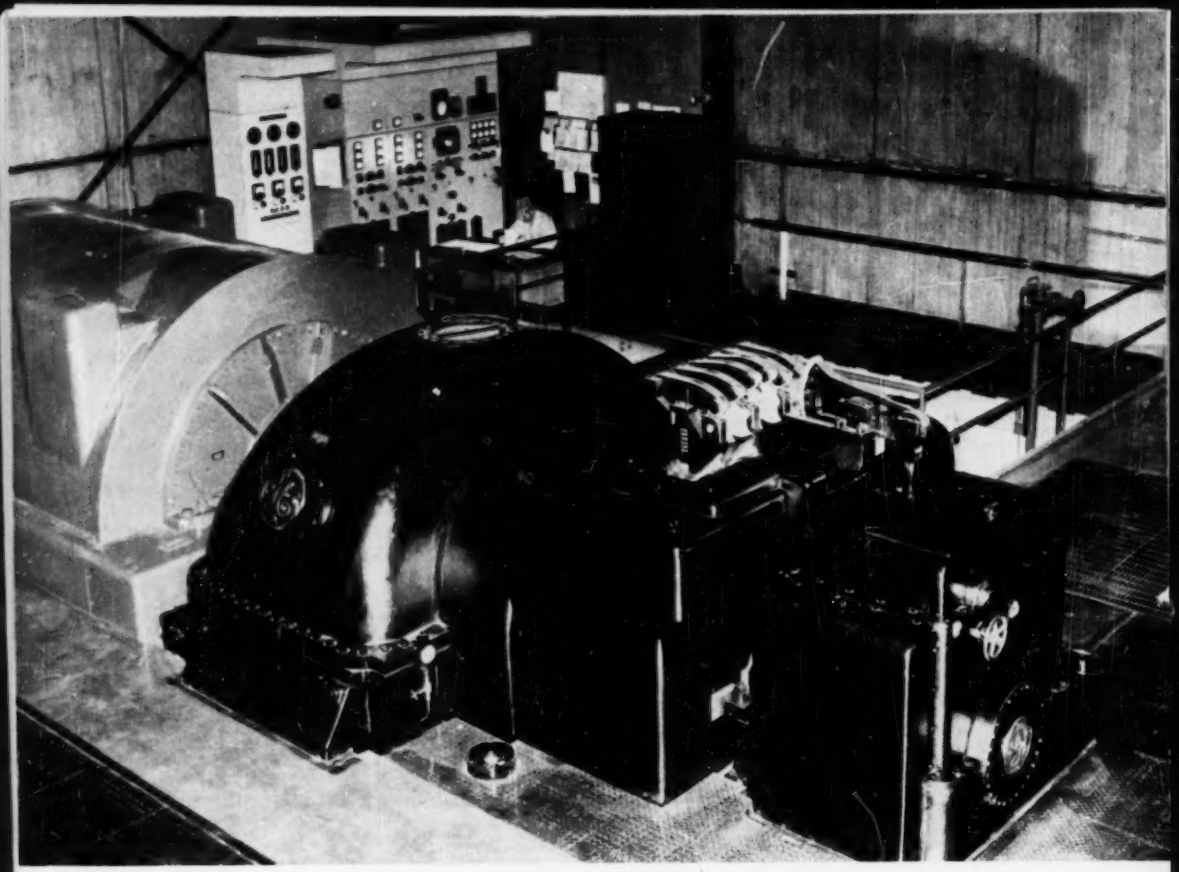

Assures trouble-free lubrication for life of new turbine

There is good reason to believe that this new 15,000-KW turbine at Ottertail Power Company's Ortonville, Minnesota, plant will never have to be shut down for oil replacement, oil system cleaning, or because of oil acidity troubles. The basis for this conviction can be found in the company's own experience with NONPAREIL Turbine Oil, lubricant for the new unit.

Since 1931, the Ottertail Power Company has put NONPAREIL into several turbines. In one of those first units, NONPAREIL has now served for 21 years, and the original fill of oil has never needed to be replaced. Although the lubricant has not been removed for treating, it has maintained a neutralization number below 0.09 mg. KOH/gm. The oil system has not required cleaning.

With this evidence of long life is the written guarantee given with each fill of oil that NONPAREIL will last as long as the turbine and will maintain a neutralization number below 0.15 mg. KOH/gm.

You can assure trouble-free lubrication for the life of your turbines by using NONPAREIL Turbine Oil. Phone your Standard Oil Company (Indiana) office for the services of a Standard lubrication specialist. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

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